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# THE ORB-WEAVER GENERA *METEPEIRA*, *KAIRA* AND *ACULEPEIRA* IN AMERICA NORTH OF MEXICO (ARANEAE: ARANEIDAE)

HERBERT W. LEVI<sup>1</sup>

**ABSTRACT.** *Metepeira* and *Kaira* are known only in the Americas. Eleven species of *Metepeira* live north of Mexico, frequently in semiarid regions. A number of species are sympatric in the southwestern United States and are often collected together. Only four species of *Kaira* have been found north of Mexico; in one of these only females are known, in another, only males. The habits of *Kaira* species remain a mystery. *Aculepeira* is mainly an Eurasian genus, but two species live in North America; both North American species also occur in Siberia. One, *A. packardi*, is found in the Arctic, in western mountains, in meadows and in sagebrush. The other, *A. carbonarioides*, has been discovered only between boulders in talus slides of the Arctic, the Rocky Mountains, the Gaspé Peninsula and the White Mountains of New Hampshire. Identification of Eurasian species was difficult because few specimens were available.

## INTRODUCTION

The genera sequence of these revisions is unfortunately not phylogenetic; instead their arrangement develops from the order in which specimens could be sorted out most easily from the available collections. I started with *Argiope* and the large species of *Araneus*. This paper includes species that have at times been confused with those in *Araneus* and other genera. When I started this revision of the three genera, I thought *Aculepeira* was close to *Metepeira*. Species of both genera have a median white streak on the venter of the abdomen, the median apophysis of the male palpus has two flagella and species of both inhabit extreme climates. The *Metepeira* species are most

abundant in semidesert, an unusual habitat for orb-weavers. The two *Aculepeira* species are found in mountain meadows and talus slopes where it is very hot during the day, but becomes freezing at night, even in midsummer. But here the similarity ends. After careful study I found *Metepeira* and *Kaira* are not closely related to *Araneus* and are limited to the Americas, but *Aculepeira* is an Old World genus close to *Araneus*. Two Siberian species of *Aculepeira* are believed to have spread over the North American continent into various "vacant" niches. At least four other species are known from Eurasia (Figs. 187-231), but no others are known from America.

For this study the collections of the Museum of Comparative Zoology (MCZ) were used. I would like to thank the following for specimens: J. A. Beatty; D. E. Bixler; J. E. Carico; R. Crabill (National Museum of Natural History); C. D. Dondale (Canadian National Collections, CNC); S. I. Frommer (University of California, Riverside Collections); M. Grasshoff (Senckenberg Museum, Frankfurt, SMF); J. Gruber (Naturhistorisches Museum, Wien); N. Horner; M. Hubert (Muséum National d'Histoire Naturelle, Paris); W. R. Icenogle; B. J. Kaston; J. B. Kethley (Field Museum); T. Kronstedt (Natural History Museum, Stockholm, NRS); R. Leech; W. B. Peck (Exline-Peck Collection); W. J. Gertsch and N. I. Platnick (American Museum of Natural History, AMNH and Cornell Uni-

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## METHODS

The method used to obtain the results presented here is the usual one: comparing specimens or those morphological features of specimens that have proven most useful in the past in taxonomy of spiders (Levi, 1977). The useful morphological characters, in all spiders, are the genitalia (the female epigynum, the male palpus); in araneids, the color patterns of the carapace and abdomen and the proportions and setation of the legs. Differences of several characters between groups of specimens are important because they indicate populations that do not interbreed. Often numerous outline drawings were made to find such differential characters.

Species differences proved subtle in *Metepeira*; these species are difficult to separate. Not only are several species sympatric, but no differences in their habits are even known at present. Unlike *Metepeira* species, the two American species of *Aculepeira* are quite variable, with no two specimens exactly alike and some specimens more than twice the size of others. Despite this variability, no populations could be segregated as having several distinct features. There is the possibility, though, that the eastern population of *A. carbonarioides* is distinct. A larger series of specimens is needed to ascertain the differences. But even if they are not distinct morphologically, can we be certain that the four isolated populations of *A. carbonarioides* are potentially interbreeding? In an attempt to answer this, I tried to raise Colorado specimens, but could not keep them alive in the laboratory.

Some of the problems of taxonomy are illustrated by the Eurasian species. Can I be sure that the three Siberian species described in the past (but with no specimens now available except for a female from Kamchatka) are the same species as those I did examine that were found in the American Arctic? While the study of specimens of the three Mediterranean species (Figs. 187-217) indicated they were far apart morphologically and easy to separate, the few specimens close to *A. armida* available from Asia were puzzling. Some that were labeled *A. karabagi* (Karol) seemed very distinct. But further specimens from Israel (one from Galilee and others from the Negev Desert) were intermediate with *A. armida*, having the characteristic lamellae posterior of the epigynum bent at right angles (Fig. 211) but much wider than the illustrated specimens from Europe. Despite this I believe *A. karabagi* to be a distinct species with the oldest name *A. noseki*. Drensky (1943) synonymized *A. victoria* Thorell with *A. armida*. Can I be sure by examining two specimens labeled *Araneus victoria* in the available collections that

Drensky was correct? I suspect Drensky was wrong, but it is impossible to obtain large series of these populations. Perhaps *A. armida* is a highly variable species and all doubtful specimens belong to it. I decided then to leave the Old World problems to a colleague closer to the critical areas (the Balkans and Asia Minor) who can resolve the question by further collecting and field observations.

### *Metepeira* F.P.-Cambridge

*Metepeira* F.P.-Cambridge, 1903, *Biologia Centrali-Americana, Araneidea*, 2: 457. Type species by original designation *M. spinipes* F.P.-Cambridge, 1903. The name is feminine.

*Note.* In 1942 Chamberlin and Ivie named 14 species of *Metepeira* and mentioned 16 others in a paper on diverse new species from the Americas. It is difficult to see this as a revisionary study since the majority of the University of Utah collections then available had not been determined (except for some immatures!). Apparently, individual specimens that looked different were picked out of the collection and named. No distinguishing features were given by Chamberlin and Ivie for the new species and only a few of the illustrations feature diagnostic characters. The usual wording in the description regarding diagnosis is "showing minor differences in the palpus," or "the palpus and epigynum are distinct as shown by the figures." Nevertheless, most of the names of Chamberlin and Ivie actually do apply to different species and only a few names are synonymized.

*Diagnosis.* *Metepeira* differs from other araneid genera in having the eye region lighter than the remainder of the carapace (when in alcohol). The posterior head region is often darkest (Figs. 3, 37, 39). Unlike most other araneid genera, *Metepeira* has a median, longitudinal white line contrasting with the black background on the venter of the abdomen (Plates 1, 2, 3; Figs. 4, 38, 40). This line is absent, however, in the light-colored *M. gosoga*, in which only two black streaks remain (Fig.

36). There are usually white spots on black background on each side of the spinnerets (Plates 1, 2; Figs. 4, 38, 40). Unlike all other genera, the white line continues on the sternum (Plates 1, 2; Figs. 4, 38, 40). The few exceptions to this are *M. foxi*, *M. grandiosa* and *M. datona* (Figs. 86, 95, 98, 100). In still another difference between *Metepeira* and most other araneid genera related to *Araneus*, the combined length of metatarsus and tarsus is longer than that of the patella and tibia of the same leg (Fig. 3). (An unusual exception is *M. datona*; Plate 4.) An additional diagnostic trait is the very small, weakly sclerotized epigynum (Fig. 14) and the small palpus that has a median apophysis bearing two filiform appendages (flagella) (Figs. 10, 19, 20, 26, 27). The palpal tibia has two strong macrosetae (Figs. 8, 10, 19), as does the palpal patella (Fig. 8) in most species. The web, too, is diagnostic (see below), differing distinctly from that of species in related genera.

*Metepeira*, like *Aculepeira*, has a ventral median white mark on the abdomen, and the median apophysis of the male palpus has two flagella. *Metepeira* differs from *Aculepeira* by having a more spherical abdomen (Figs. 3, 4) and by the relatively smaller genitalia with a different structure. *Metepeira* is close to *Kaira* but the *Metepeira* abdomen is spherical (Figs. 3, 4); the *Kaira* abdomen is higher than long with tuberculate dorsal humps (Figs. 122-126) and the ventral abdominal mark is indistinct.

*Description.* The carapace has the anterior of the head lighter and, in all species, it is covered by white down (Plates 1, 2, 3). The thoracic depression is an indistinct longitudinal shallow groove. In all species the anterior median eyes are slightly larger or subequal in size with the others (Figs. 1, 5). Also in all species, the anterior median eyes are separated from each other by their diameter or slightly more, and from the laterals by one to one and one-half diameters (Figs. 1, 5). The posterior median eyes are



Plate 1. *Metepeira labyrinthea*. Upper left, female (Florida). Right, retreat, in barrier-web, and orb (Indiana); photo B. Opell. Bottom, orb with barrier-web and retreat, cornstarch dusted (Tavernier, Florida). Horizontal diameter of viscid area of web, 23 cm.

slightly less than their diameter apart in females, and two to three diameters from the laterals (Fig. 1). In males the posterior median eyes are their radius to slightly less than their diameter apart, and one and one-half to slightly more than two diameters from the laterals (Fig. 5). The height of the clypeus is less than the diameter of the anterior median eyes. The endites are longer than in many other araneid genera (Fig. 2). The legs are banded (Plates 1, 2; Fig. 3). The abdomen is usually oval, but spherical in *M. foxi* and *M. grandiosa* (Figs. 94–100) and is wider than long in *M. datona* (Plate 3; Fig. 85). The abdomen always has a dorsal folium pattern, which is more distinct posteriorly, and there may be black shoulder patches anterior-laterally (Plates 1, 2; Figs. 3, 68, 85). The black venter, with its characteristic white streak (Plate 1), contrasts with the light dorsum.

Living *Metepeira labyrinthea*, *M. grinnelli* and *M. crassipes*, as well as *M. foxi* and *M. datona* that I have seen and photographed, have on the abdomen, especially to the sides of the folium, some red pigment that washes out in alcohol. *Metepeira grinnelli* has reddish areas on the borders of the white line on each side of the folium, and anteriorly the folium has black pigment grading into brown. There is also a reddish brown area on the venter on each side of the black mark.

Males have no hook on the first coxa and no groove on the second femur. The male's first femur has strong macrosetae anteriorly, with the largest medially in the *M. foxi* group (Fig. 96), and distally in other groups (Figs. 12, 13). The fourth coxae are not modified. While males are smaller than females, in most species they do come in various sizes—some small, some larger, the larger ones presumably having gone through more instars and a longer period of growth.

The proportions of most species are about the same and the sizes overlap, but members of the *M. foxi* group are, in general,

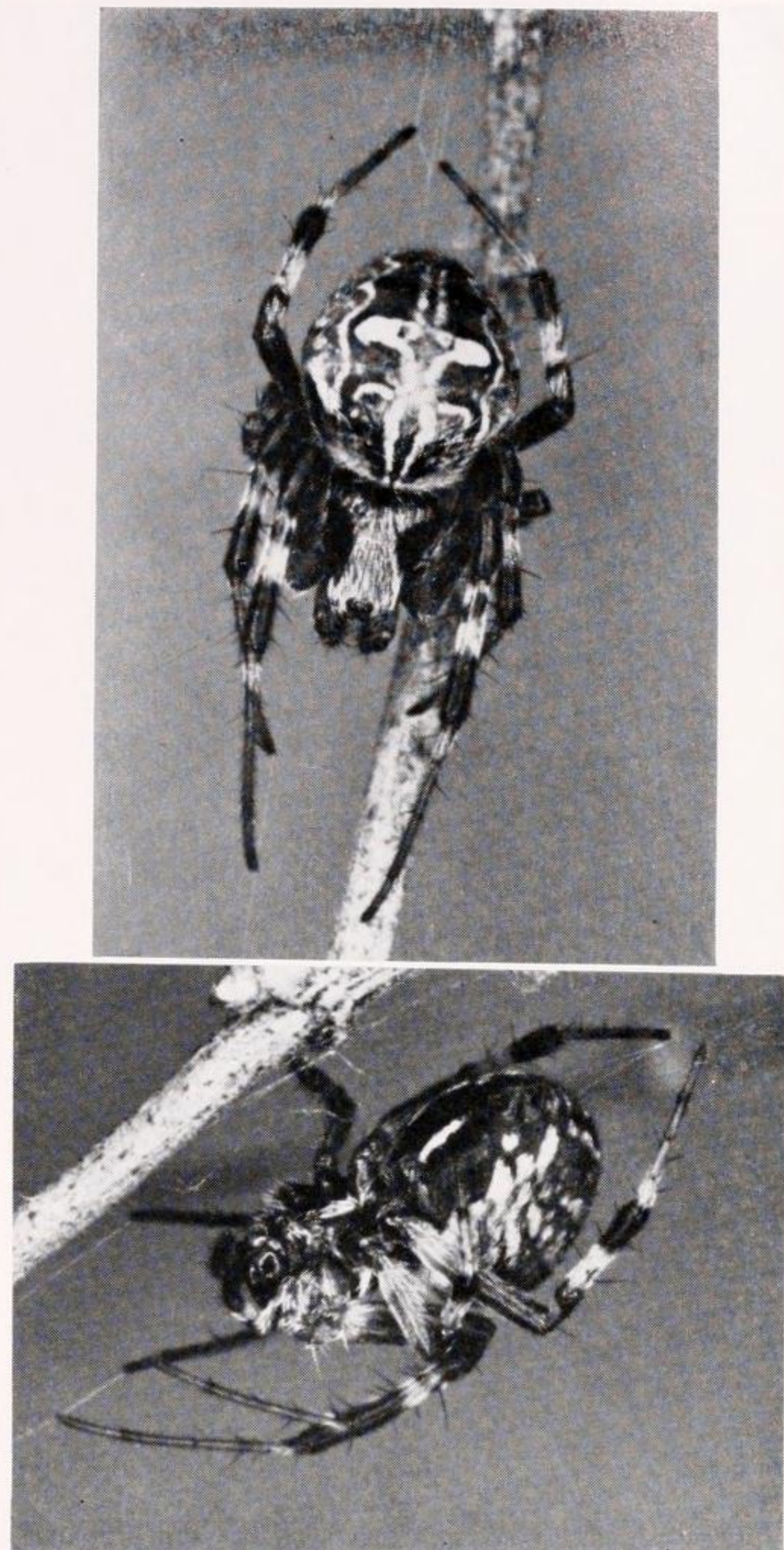


Plate 2. *Metepeira grinnelli*, female (Arizona).

slightly smaller. Measurements of a female *M. labyrinthea* from Virginia are: total length 7.0 mm; carapace 2.8 mm long, 2.2 mm wide. First femur, 3.8 mm; patella and tibia, 3.9 mm; metatarsus, 3.6 mm; tarsus, 1.2 mm. Second patella and tibia, 3.1 mm; third, 1.9 mm; fourth, 2.9 mm. Measurements of a male from Virginia are: total length 4.2 mm; carapace 1.9 mm long, 1.6 mm wide. First femur, 3.3 mm; patella and tibia, 3.2 mm; metatarsus, 3.4 mm; tarsus, 1.1 mm. Second patella and tibia, 2.6 mm; third, 1.3 mm; fourth, 1.8 mm.



Plate 3. *Metepeira crassipes* (Riverside Co., California). Upper photographs, females, dorsal. Lower left, female venter; right, male. Laboratory photographs.

*Genitalia.* The epigynum is very small and lightly sclerotized, making it difficult to study (Fig. 14). The openings are in a species-characteristic depression (Fig. 18). Because of the small size of the soft structure, it is necessary, when the species is uncertain, to examine it as a temporarily cleared microscope mount. Below the opening is a sclerotized spherical structure from which ducts lead to the seminal receptacles (Figs. 18, 25, 32).

The femur of the male palpus lacks the pointed tooth usually present on the proximal end in all related genera and also lacks the tooth of the endite that is usually facing that of the femur. The median apophysis of the palpus bears two flagella (Figs. 10, 20) and often has a keel distally (ventrally on the palpus) (Figs. 10, 26, 27, 91, 93, 109, 111). Even though the median apophysis is the most prominent part of the palpus, its shape varies and, therefore, it



is only occasionally of diagnostic value. The shape of the triangular conductor (Figs. 10, 11) is similar in many species, but is wider than long in *M. foxi* (Fig. 92). Of greatest importance for diagnosis is the embolus, which is hidden partly behind the flagella of the median apophysis and partly by the overhanging terminal apophysis (Figs. 9, 10, 19, 26). The portion of the embolus containing the duct has a soft lobe hanging above it in some species (Figs. 9, 10, 20, 27, 34). Because of its diagnostic importance, it is unfortunate that this lobe is partly hidden. In virgin males the embolus is capped (Figs. 34, 52). The cap has been lost in presumably mated males (Figs. 33, 51). The cap, which has a minute barb at its tip, is found in the opening of the epigynum, plugging it (Figs. 25, 73), and apparently preventing a second mating of the female. There is never more than one cap found on each side in the epigynum. This cap contains an open duct in *Metepeira*. Some palpi (when handled through different solutions) emit tube-shaped material from their tips, probably propelled outward by osmotic pressures. Below the section of the embolus carrying the duct is a larger lobe in all species that projects on the outside of the conductor (right in the left palpus) in ventral view (Figs. 9-11) in the contracted palpus. Large and small males of the same species may have slightly different proportions in the softer parts of the palpus, but not in the embolus.

*Natural History.* *Metepeira* has an orb and a barrier-web—an irregular web to the side and slightly above. Lubin (1975) recently suggested that the barrier web may be a moisture gathering device. The orb may be incomplete on top (Plate 1). The hub has a mesh and several trap lines travel from the hub to the retreat in the center of the barrier-web (Plates 1, 5). The retreat is a small cap of silk covered by insect remains or leaves (Plates 1, 5). The web of *M. labyrinthea* is often in dead branches. Egg-sacs are brown, lenticular and hung in



Plate 4. *Metepeira datona*, female (Florida).

a string below the retreat with the most recent on the bottom (Comstock, 1940; Kaston, 1948). According to Kaston (1948), *M. labyrinthea* has about 35 radii and there are 5 to 6 egg-sacs with up to 63 eggs. The cocoon lasts until spring. *Metepeira* in Riverside County, California observed by Icenogle (personal correspondence) feed, to a great extent, on crane flies. Comstock claims that *M. labyrinthea* matures in fall, but in the collections there are mature males and females gathered from early summer to fall. Judging by *Metepeira*'s abundance in semidesert areas, the dense retreat and barrier-web must provide sufficient protection against desiccation. In many habitats it is the only orb-weaver found. One Mexican and Central American species, *M. spinipes* F.P.-Cambridge, is colonial, the others are not.

The *Metepeira* species of the eastern states are known to have very different habitat preferences: *M. labyrinthea* usually places its webs in shrubs of deciduous forests; *M. grandiosa palustris* selects north-



Plate 5. Orb-web, barrier-webs and retreats of *Metepeira grandiosa alpina* from Colorado. Upper left, side view, sprayed with Krylon® white paint. Upper right, side view, dusted with cornstarch. Bottom, frontal view from slightly below, dusted with cornstarch. Diameter of viscid area of lower web about 25–30 cm.

ern bogs; and *M. datona* uses shaded shrubs on ocean shores. One might thus expect the numerous western species to each have different habitats. But four species (*M. crassipes*, *M. ventura*, *M. foxi* and *M. g. grandiosa*) have all been found side by side in California buckwheat (*Eriogonum fasciculatum*) and sage (*Artemisia californica*) in Riverside County, California. The first two species are commonly found in this environment, according to the best documented collections by W. Icenogle.

All species are commonly preyed upon by mud-dauber wasps of the genera *Trypoxylon* and *Trypargilum* (Sphecidae).

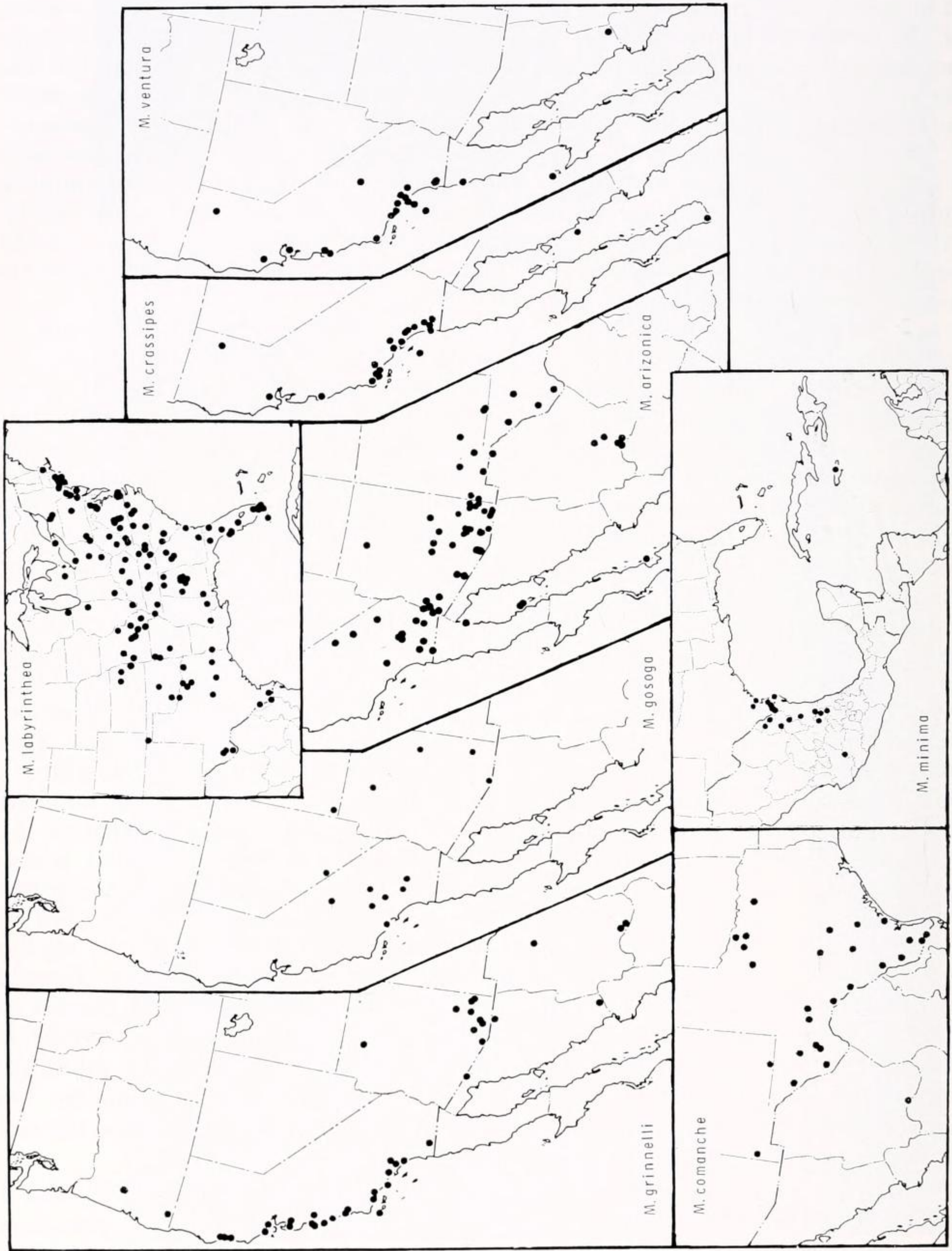
*Species.* No *Metepeira* species are known from other continents, all are American, and they range from Alaska to Tierra del Fuego. All, at one time or another, have been referred to as *M. labyrinthea* because of their similar size and coloration. (*Metepeira foxi* and *M. datona* are smaller than most species.) Roewer (1942) gives the distribution of *M. labyrinthea* from Patagonia to Labrador; Bonnet (1957) claims it extends from Canada to Patagonia, Chile, as well as appearing in east Africa. Actually it has a very limited distribution, occurring only in the eastern United States (Map 1).

*Systematic characters.* Numerous characters were checked and illustrated in the hope of finding discontinuities or of finding characters that would go together, thus indicating species. I studied absolute sizes, proportions, coloration and color pattern, and the ventral and anterior macrosetae of the male femora. Color pattern is useful to segregate the *M. gosoga* and the *M. foxi* group of species. More macrosetae are present in large specimens of each species than in small ones, so I did not find these setae very useful (Figs. 12, 13); however, males of the *M. foxi* group (*M. datona*, *M. foxi*, *M. grandiosa*) have the longest macrosetae in the middle of the femur (Fig. 96), while the *M. labyrinthea* has them distally (Fig. 6). Various aspects of the epigynum, different ones in different species, are useful. The shape of the terminal apophysis of the

palpus segregates the *M. labyrinthea* and *M. foxi* species groups (Figs. 19, 91). The conductor, because it is too similar and variable, is not of much use. The median apophysis, which is sometimes very distinct, is variable and therefore of doubtful use alone, but when used with the shape of the embolus it proves a satisfactory character. Matching males with females of the same species can be a problem. It is helpful to collect males with females because this facilitates identifications, in some species the male, in others the female, is easiest to determine.

*Species groups.* The species north of Mexico belong to two species groups: *M. labyrinthea* and *M. foxi*. The *M. labyrinthea* group has a longitudinal white line across the sternum (Fig. 4); the median apophysis of the male palpus has only a short distal keel beyond the flagella-bearing proximal part (Figs. 10, 19, 20, 26, 27). All species within this group are about the same size. Species in the *M. foxi* group have a black sternum (Fig. 95) and the median apophysis of the palpus has a distal (ventral on the palpus) tuberculate keel (Figs. 91, 93, 104, 105, 115, 116). The species in this group are smaller in size. Two of the three species of the *M. foxi* group are common and come in large numbers in collections. It is interesting that of the species of the *M. labyrinthea* group, whose sternal white line is often broken and partly missing (Fig. 38), *M. grinnelli* also has an extension (though relatively small) on the median apophysis beyond the flagella (Figs. 26, 27). It is difficult at present to decide which of these species groups is the derived and which the more primitive. I consider *M. datona* most primitive because of the shorter metatarsus and the less specialized coloration.

*Metepeira grandiosa* is puzzling and I consider all specimens to be *M. grandiosa* with three subspecies for the three distinct allopatric forms. I have a suspicion, however, that with more data, some will turn out to be distinct.



Map 1. Distribution of *Metepeira labyrinthea*, *M. grinnelli*, *M. comanche*, *M. grinnelli*, *M. gosoga*, *M. minima*, *M. crassipes*, *M. arizonica*, *M. ventura*, *M. comanche* and *M. minima*.

KEY TO FEMALE *METEPEIRA* NORTH OF MEXICO

- 1. Sternum black (Figs. 95, 98, 100), sometimes in Florida specimens with a lighter brown anterior and posterior patch (Fig. 86) ..... 2
- Sternum with a white longitudinal band (Figs. 4, 36, 40), rarely broken and partly missing (Fig. 38) ..... 6
- 2(1) Abdomen wider than long, anterior half of dorsum light (Plate 4; Fig. 85); openings of epigynum on each side in depression (Fig. 78); Florida coast ..... *datona*
- Abdomen spherical to slightly longer than wide, usually with a dorsal folium (Figs. 94-100); opening of epigynum hidden (Figs. 87, 101-112); most of area but not in southeastern United States ..... 3
- 3(2) Coxae black like sternum (Fig. 98); Canada, south to Maine and South Dakota (Map 2) ..... *grandiosa palustris*
- Coxae light yellowish to orange ..... 4
- 4(3) Epigynum with a bordered, longitudinal depression on each side of narrow scape (Fig. 87); western United States (Map 2) ..... *foxi*
- Epigynum with transverse depression (Figs. 101, 106, 112); North Dakota, Colorado, western United States ..... 5
- 5(4) Epigynum scape wide at base (Fig. 106); in posterior view middle piece shorter ventrally than lateral ones (Fig. 107); western Canada to Oklahoma; Chihuahua west to eastern Oregon (Map 2) ..... *grandiosa alpina*
- Epigynum scape usually narrow, sometimes with a slight median ridge (Fig. 112); in posterior view middle piece about same length ventrally as lateral ones (Fig. 113); British Columbia to California (Map 2) ..... *grandiosa grandiosa*
- 6(1) Epigynal scape fleshy triangular, greatest width as wide or wider than visible base on either side (Figs. 41-43); depressions on each side of scape small, visible diameter less than diameter of their rim (Fig. 41); western Texas, Chihuahua, to California and Gulf of California (Map 1) ..... *arizonica*
- Scape otherwise an equal to or narrower than base visible to side of it (Figs. 14, 21, 47); depressions small or larger (Figs. 47, 53, 61) ..... 7
- 7(6) Visible depression on each side of scape appearing as anterior-posterior slits with their lateral borders parallel (Fig. 70); southern Texas to central Mexico, West Indies (Map 1) ..... *minima*

- Depression otherwise (Figs. 14, 28, 47) ..... 8
- 8(7) Posterior rim of depression narrow (Fig. 61) and a round opening visible on each side in posteroventral view (Fig. 62); Texas, New Mexico to Chihuahua (Map 1) ..... *comanche*
- Epigynum otherwise (Figs. 14, 53) .... 9
- 9(8) Eastern North America to western Oklahoma, western Texas (Map 1); epigynum as in Figs. 14-18 .. *labyrinthea*
- Western United States, New Mexico to Pacific coast ..... 10
- 10(9) Carapace light brown, with posterior head dark (Fig. 35) and whitish abdomen with two ventral black streaks (Fig. 36); epigynum as in Fig. 28; Utah, Nevada, Arizona to California (Map 1) ..... *gosoga*
- Carapace, except for eye area, dark brown (Figs. 39, 59) and venter of abdomen black with median white longitudinal line (Figs. 40, 60); epigynum otherwise ..... 11
- 11(10) Width of scape less than one-fourth width of epigynal base (Fig. 53); posterior rim of depression narrow (Fig. 53); California, Sonora and Baja California (Map 1) ..... *ventura*
- Width of scape about one-third width of epigynal base (Figs. 21, 47); posterior rim of depression wider (Figs. 21, 47); Arizona, Oregon to California ..... 12
- 12(11) Depressions round and small with width of posterior border wider than visible diameter of depression (Fig. 47); California to Baja California (Map 1) ..... *crassipes*
- Depression flaring and width of its posterior border narrower than visible diameter of depression (Fig. 21); Arizona to Oregon and California, Chihuahua and Sonora (Map 1) ..... *grinnelli*

KEY TO MALE *METEPEIRA* NORTH OF MEXICO

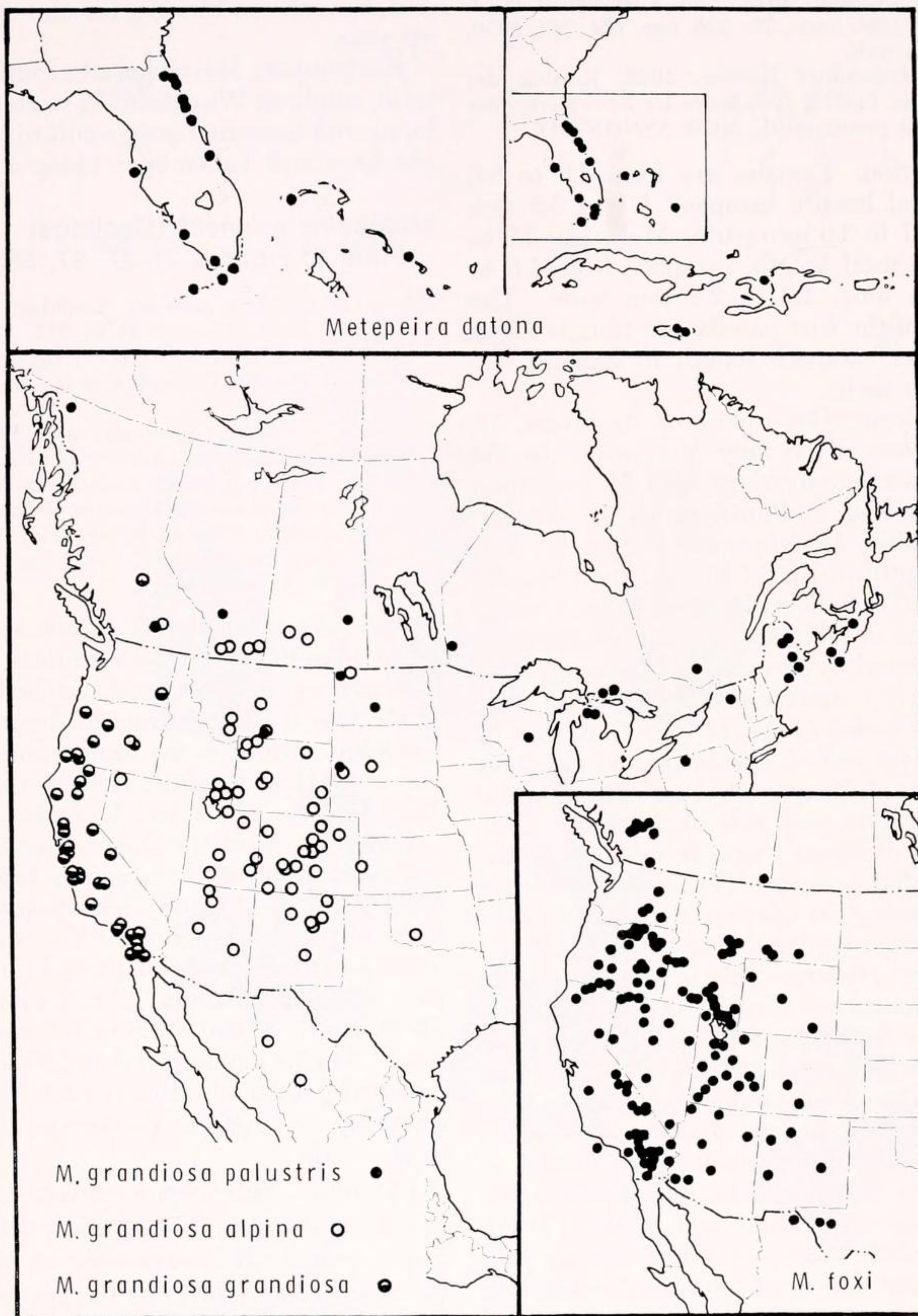
- 1. Sternum black, without longitudinal light line (Figs. 86, 95, 98, 100); base of palpal embolus at the distal tip of bulb (Figs. 82, 91, 109); median apophysis with a prominent ventrally directed tubercular keel beyond base of two flagella (Figs. 84, 93, 111) ..... 2
- Sternum with a median longitudinal light band (Figs. 4, 36, 38); terminal apophysis overhanging palpal embolus (Figs. 10, 11, 19, 26); median apophysis without such a keel or with only a small smooth extension (Figs. 21, 27, 34, 46) ..... 6

- 2(1) Embolus thick as in Figs. 82, 84; terminal apophysis a narrow, curved, soft prong (Fig. 83); Florida coast — *datona*  
 — Embolus thin (Figs. 91, 104, 105, 109, 111, 115, 116); terminal apophysis otherwise (Figs. 92, 104, 109, 110, 115); whole region except southeastern United States ..... 3
- 3(2) Coxae black like sternum (Fig. 98); Canada, south to Maine and South Dakota (Map 2) ..... *grandiosa palustris*  
 — Coxae light yellowish to orange; western North America ..... 4
- 4(3) Embolus of palpus with thin terminal part pointed at 45° angle to wider basal portion (Figs. 91, 93); tubercular keel of median apophysis larger than proximal flagella bearing part (Figs. 91, 93); western United States (Map 2) — *foxi*  
 — Embolus of palpus with terminal part curved at right angle to wider basal portion (Figs. 104, 105, 109, 111, 115, 116); tubercular keel of median apophysis equal to or smaller than proximal flagella bearing part (Figs. 105, 111, 116); North Dakota, Colorado and western United States ..... 5
- 5(4) Terminal part of embolus narrower (Fig. 111); western Canada to Oklahoma, Chihuahua, west to eastern Oregon, eastern California (Map 2) ..... *grandiosa alpina*  
 — Terminal part of embolus wider (Fig. 116); British Columbia to California (Map 2) ..... *grandiosa grandiosa*
- 6(1) Embolus of palpus with a parallel lobe above terminal portion containing duct (Figs. 20, 27, 34); lobe partly hidden by terminal apophysis (Figs. 19, 26, 33) ..... 7  
 — Embolus of palpus without such a lobe (Figs. 46, 52, 58, 67) ..... 9
- 7(6) Embolus tip strongly curved, the lower edge of its base concave (Fig. 20) and median apophysis with an indistinct small keel beyond flagella (Figs. 19, 20); eastern United States to western Oklahoma and western Texas (Map 1) ..... *labyrinthea*  
 — Embolus tip less curved (Figs. 27, 34) and median apophysis with larger keel (Fig. 27) or no keel; western United States ..... 8
- 8(7) Embolus curved and lobe overhanging tip (Fig. 27); median apophysis with a keel beyond flagella (Figs. 26, 27); Arizona to Oregon and California, Chihuahua and Sonora (Map 1) ..... *grinnelli*  
 — Embolus tip with upper edge straight and lobe less than half length of tip (Fig. 34); median apophysis without keel (Fig. 34); Utah, Nevada, Arizona to California (Map 1) ..... *gosoga*
- 9(6) Proximal flagellum of median apophysis (left one of left palpus) more than four times length of distal one (Figs. 74, 75); southern Texas to central Mexico, West Indies (Map 1) ..... *minima*  
 — Proximal flagellum of median apophysis less than three times length of distal one (Figs. 46, 58); Texas, California and southwestern United States ..... 10
- 10(9) Base of embolus with a distinct lobe at base of tip (Figs. 66, 67); Texas, New Mexico to Chihuahua (Map 1) — *comanche*  
 — Embolus otherwise or if with lobe; not from Texas or New Mexico ..... 11
- 11(10) Embolus gracefully curved, fairly long (Figs. 45, 46); base of median apophysis wide and both flagella recurved (Figs. 45, 46); western Texas, Chihuahua to California and Gulf of California (Map 1) ..... *arizonica*  
 — Embolus curved but shorter (Figs. 52, 58); base of median apophysis narrow, distal flagellum not recurved (Figs. 52, 58); Oregon to Baja California, Sonora ..... 12
- 12(11) Proximal flagellum of median apophysis, noticeably longer and much wider than transparent distal one (Figs. 57, 58); median apophysis higher (Figs. 57, 58); California, Sonora and Baja California (Map 1) ..... *ventura*  
 — Proximal flagellum of median apophysis almost subequal in length and width to distal one (Figs. 51, 52); median apophysis narrower (Figs. 51, 52); California to Baja California (Map 1) ..... *crassipes*

***Metepeira labyrinthea* (Hentz)**

Plate 1; Figures 1–11, 14–20; Map 1

*Epeira labyrinthea* Hentz, 1847, J. Boston Soc. Natur. Hist., 5: 471, pl. 31, fig. 3, ♀. Type specimens from North Carolina and Alabama, destroyed. Emerton, 1884, Trans. Connecticut Acad. Sci., 6: 314, pl. 34, fig. 8, pl. 36, fig. 11, ♀, ♂. Keyserling, 1893, Spinnen Amerikas, 4: 215, pl. 10, fig. 160, ♀, ♂. Emerton, 1902, Common Spiders, p. 174, figs. 408–410, ♀, web.  
*Epeira crucifera* Keyserling, 1864, Sitzungsber. Naturwiss. Gesell. Isis, Dresden, p. 132, pl. 6, figs. 11, 12, ♀. Female holotype from Baltimore in the British Museum, Natural History, examined. (The locality of Baltimore is not pub-



Map 2. Distribution of *Metepeira datona*, *M. grandiosa* and *M. foxi*.

lished but is on the label in the vial. Name preoccupied by Lucas, 1835.)  
*Metepeira labyrinthea*:—F.P.-Cambridge, 1903, *Biologia Centrali-Americana*, Araneidae, 2: 458,

pl. 43, figs. 6, 7, ♀, ♂. Comstock, 1940, *The Spider Book*, rev. ed., p. 476, figs. 187, 476–479, ♀, ♂, web. Chamberlin and Ivie, 1942, *Bull. Univ. Utah, biol. ser.*, 7(1): 63, figs. 161–164,

♀, ♂. Kaston, 1948, *Bull. Connecticut Geol. Natur. Hist. Surv.*, 70: 226, figs. 704, 724, 2036, ♀, ♂, web.

*Aranea keyserlingi* Roewer, 1942, *Katalog der Araneae*, 2: 861. New name for *Epeira crucifera* thought preoccupied. NEW SYNONYMY.

*Variation.* Females are from 4.0 to 8.6 mm total length, carapace 1.7 to 3.5 mm long, 1.1 to 3.0 mm wide. Males are 3.0 to 6.8 mm total length, carapace from 1.6 to 3.0 mm long, 1.2 to 2.2 mm wide. The length of the first patella and tibia is 1.2 to 1.3 times carapace length in females, 1.6 times in males.

*Diagnosis.* Over most of its range, *M. labyrinthea* is the only *Metepeira*. In the north its range overlaps with *M. grandiosa palustris* and in Florida with *M. datona*; both, unlike *M. labyrinthea* (Fig. 4), lack the longitudinal light line on the sternum. Only in Texas does *M. labyrinthea* overlap the range of other species, and females can be separated by the scape of the epigynum, which has a narrow neck at its base. The scape is wider (Figs. 14, 15) than that of *M. minima* and *M. comanche* and narrower than that of *M. arizonica*, and the epigynal depression on each side of the scape (Fig. 18) is a different shape from those of the three other species. The embolus, unlike these three other species, is strongly curved with a lobe overhanging it (Figs. 19, 20).

*Natural History.* This is a forest species and is found on shrubs. It has been collected in floodplain forest in Tennessee, in thick forest on trees and bushes in Virginia, on the edge of oak woods and fields in Wisconsin, in oak, hickory and birch woods in Missouri, in a deciduous forest in Kansas, in woods in Texas and in the shade below trees growing among cacti in the Florida Keys. Adult males are found during July and August, females from spring to late fall,

and, in southern Florida, females are found all year.

*Distribution.* Massachusetts, southern Ontario, southern Wisconsin, to western Oklahoma and western Texas, south to the Florida Keys and Tamaulipas (Map 1).

### *Metepeira grinnelli* (Coolidge)

Plate 2; Figures 21–27, 37, 38; Map 1

*Epeira labyrinthea grinnelli* Coolidge, 1910, *J. Entomol. Zool.*, Claremont, 2: 281. There are no type specimens in the Los Angeles County Museum, Pomona College or in the major arachnid collections.

*Metepeira douglasi* Chamberlin and Ivie, 1941, *Bull. Univ. Utah, biol. ser.*, 6(3): 18, figs. 21–23, ♀. Female holotype from Santa Ana, California in the American Museum of Natural History, examined. Chamberlin and Ivie, 1942, *Bull. Univ. Utah, biol. ser.*, 7(1): 66, figs. 169–170, ♂. NEW SYNONYMY.

*Note.* Females of this species are often larger than those of *M. labyrinthea*, the coloration is more pronounced and the banding of the legs is more distinct as described by Coolidge. Also it is the most common species of the three localities cited by Coolidge: Palo Alto, Pasadena and Lompoc.

*Variation.* Most specimens have the ventral white line of the sternum broken by black pigment (Fig. 38); sometimes the anterior or posterior part of the line is missing. Total length of females 5.0 to 9.4 mm, carapace 2.3 to 4.1 mm long, 1.7 to 3.4 mm wide. Total length of males 3.6 to 6.7 mm, carapace 1.9 to 3.3 mm long, 1.4 to 2.6 mm wide. The first patella and tibia is 1.2 to 1.4 times the carapace length in the female, 1.5 to 1.7 in the male.

*Diagnosis.* This species tends to be larger in size and darker in coloration than sympatric species. It is very close to *M. labyrinthea*. Females differ by the longer scape,

Figures 1–11. *Metepeira labyrinthea* (Hentz). 1–4. Female: 1. Eye region and chelicerae. 2. Lateral. 3. Dorsal. 4. Ventral. 5–11. Male: 5. Eye region and chelicerae. 6. Left femora, ventral. 7. Dorsal. 8. Left cymbium, tibia and patella; bulb removed. 9. Left median apophysis, conductor and embolus, pulled apart. 10. Left palpus, expanded. 11. Left palpus, ventral view.

Figures 12, 13. *M. arizonica* Chamberlin and Ivie, left male femora, ventral view: 12. (Chiricahua Mountains, Arizona.) 13. (Canyon Lake, Maricopa County, Arizona.)





*Abbreviations.* a, terminal apophysis; c, conductor; e, embolus; h, hematodocha; m, median apophysis; y, cymbium.

*Scale lines.* Figs. 1-7, 12-13, 1.0 mm; Figs. 8-11, 0.1 mm.

which does not have the neck of that of *M. labyrinthea*. Also, in a posteroventral view of the epigynum, the openings appear in two circular dark areas (Fig. 22), those of *M. labyrinthea* in a dark streak (Fig. 15). *M. grinnelli* differs from *M. arizonica* in having the posterior head region darker usually than the thorax to the sides (Fig. 37). While most females can readily be separated from *M. arizonica* by the much narrower scape and rims (Fig. 21), and from *M. ventura* by the wider scape and wider rims, they can be distinguished as well by the pockets of the median depression (Fig. 25) that are visible ventrally using a cleared posterior view. The epigynum differs from that of *M. crassipes* by the longer scape and larger depression on each side (Fig. 21). The embolus of the male is not as strongly curved as that of *M. labyrinthea* (Figs. 26, 27) and its overhanging lobe is larger (Fig. 27). Most distinct is the ventral extension, or keel, of the median apophysis that extends beyond the two flagella (on the right of the left palpus, Figs. 26, 27) and is less distinct in *M. labyrinthea*. This keel is variable in shape.

*Natural History.* Adult males are found from July to September, females from July to October; in Sonora females are found in April. None of the specimens in collections come with ecological data.

*Distribution.* Arizona, Oregon, California to Chihuahua and Sonora (Map 1).

#### *Metepeira gosoga* Chamberlin and Ivie Figures 28–36; Map 1

*Metepeira gosoga* Chamberlin and Ivie, 1935, Bull. Univ. Utah, biol. ser., 2(8): 21, figs 82–83, ♀. Female holotype from Pilot Knob Valley, Mohave Desert [34 km west of Johannesburg, San Bernardino County], California in the American Museum of Natural History, examined.

*Variation.* Total length of females 7.5 to 9.4 mm, carapace 3.2 to 4.1 mm long, 2.4 to 3.2 mm wide. Total length of males 4.4 to 5.8 mm, carapace 2.3 to 2.9 mm long, 1.7 to 2.4 mm wide. The first patella and tibia of females is 1.1 to 1.2 times the carapace length, that of the male 1.4 times.

*Diagnosis.* *Metepeira gosoga* can readily be recognized by the light colored carapace having only the posterior head region dark, by the white abdomen, which only posteriorly shows a folium (Fig. 35), and by the two adjacent ventral black marks surrounded by white pigment (Fig. 36). The middle piece of the epigynum in posterior view is sclerotized at its dorsal end (toward the abdomen) but not ventrally toward the short stubby scape. In cleared posterior view the ventrolateral pockets each have a median extension (Fig. 32) that is not present in the related species of *M. grinnelli*, *M. arizonica* and *M. labyrinthea*. The embolus of the male has a lobe above (Fig. 34), but unlike that of *M. grinnelli* and *M. labyrinthea*, the lobe is shorter than the sclerotized part bearing the duct (Fig. 34).

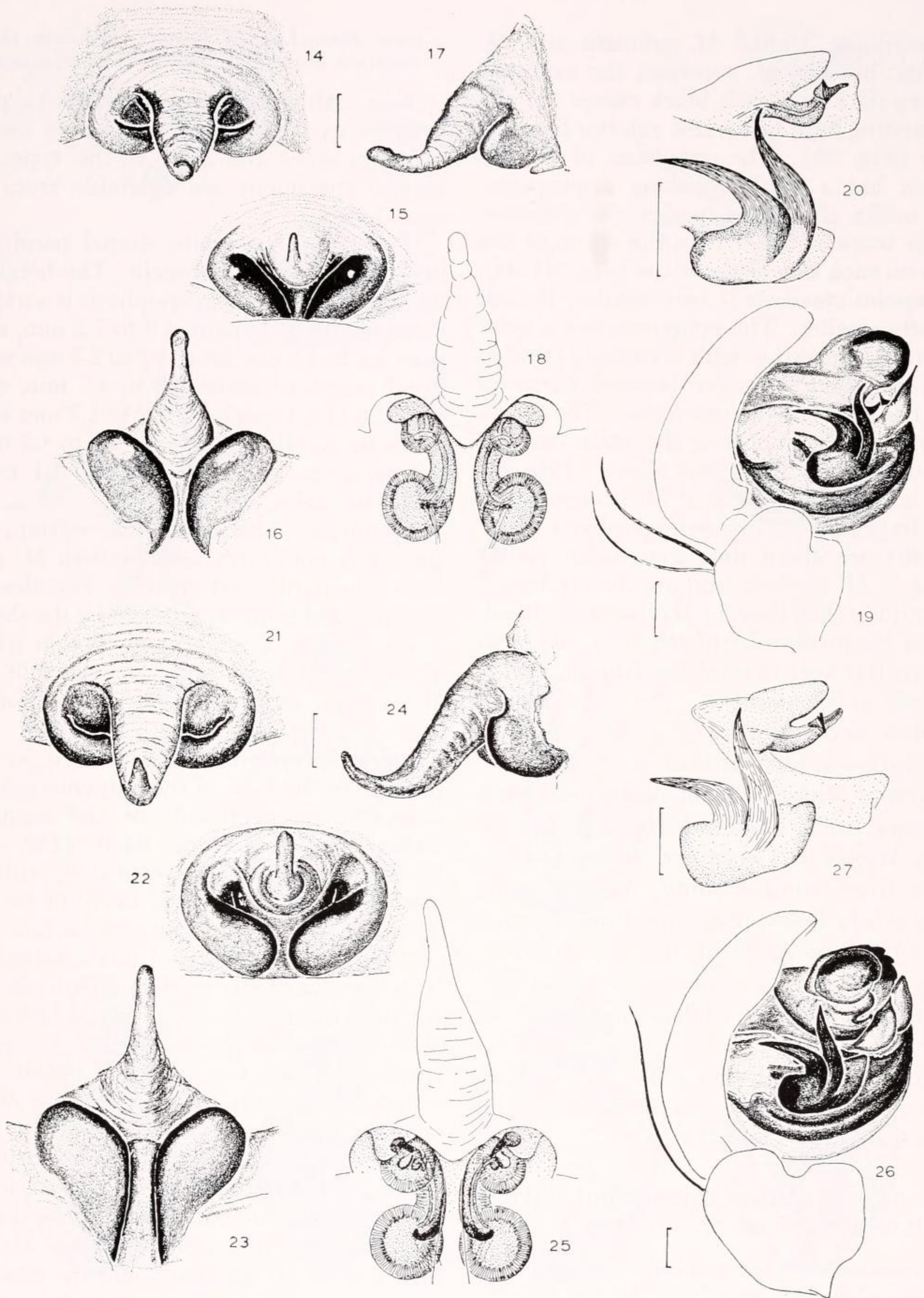
*Natural History.* Adult males and females have been collected from June to August. The only specimen with notes was collected on a cholla cactus (*Opuntia* sp.). It is likely that this species is often found on desert vegetation.

*Distribution.* Southern Utah to southern Arizona west to California (Map 1). One specimen from Mount Tamalpais State Park, near Bootjack, Marin County, California, 28 Nov. 1968 (M. Bentzien) was considered doubtful and is not mapped.

#### *Metepeira arizonica* Chamberlin and Ivie Figures 12, 13, 39–46; Map 1

*Metepeira arizonica* Chamberlin and Ivie, 1942, Bull. Univ. Utah, biol. ser., 7(1): 69, figs. 182–187, ♀, ♂. Female holotype, paratypes from Canyon Lake, W 111° 30' : N 33° 30', Arizona [Tonto National Forest, 25 mi. east of Phoenix, Maricopa Co.], in the American Museum of Natural History, examined.

*Variation.* Rare specimens are light in color on the carapace and dorsum. Total length of females 4.7 to 8.4 mm, carapace 2.0 to 3.5 mm long, 1.5 to 2.3 mm wide. Total length of males 2.7 to 3.8 mm, carapace 1.5 to 1.9 mm long, 1.2 to 1.6 mm wide. The first patella and tibia of the female is 1.1 to 1.2 times the carapace length, that of the male 1.3 to 1.4.



Figures 14-20. *Metepeira labyrinthea* (Hentz). 14-18. Epigynum: 14. Ventral. 15. Posteroventral. 16. Posterior. 17. Lateral. 18. Posterior, cleared. 19. Left male palpus, mesal. 20. Median apophysis and embolus.

Figures 21-27. *M. grinnelli* (Coolidge). 21-25. Epigynum. 21. Ventral. 22. Posteroventral. 23. Posterior. 24. Lateral. 25. Posterior, cleared. 26. Male palpus, mesal. 27. Median apophysis and embolus.

Scale lines. 0.1 mm.

*Diagnosis.* Unlike *M. grinnelli* and *M. gosoga*, but like *M. crassipes*, the carapace is very dark brownish black except for the contrasting light transverse anterior head region (Fig. 39). The epigynum of *M. arizonica* has a swollen-looking appearance, and unlike all related species, the diameter of the scape is wider than the width of the base on each side of the scape (Figs. 41–44). *Metepeira crassipes* is very similar, though slightly smaller. The epigynum has a similar small depression with seemingly swollen lips; the scape, however, is much narrower and has a proximal constriction. The gracefully curved embolus of the male (convex below and lacking a lobe above (Figs. 45, 46) is longer than that of *M. ventura*. The two flagella of the median apophysis (Figs. 45, 46) are about the same width, unlike those of *M. ventura*, and are directed more posteriorly than those of *M. crassipes*. In addition, the median apophysis (Fig. 46) lacks the ventral keel beyond the flagella that is present in *M. grinnelli*. The sternal light band is never broken (Fig. 40), while in *M. ventura* it often is broken.

*Natural History.* Adult males have been collected from March to November, females from March to December. Several specimens from Yuma County, Arizona came from alfalfa fields, one came from a cactus in Organ Pipe National Monument; others were from oak-pine-juniper woodland in Cave Creek Canyon, Chihuahua Mountains, Arizona.

*Distribution.* Western Texas, northern Arizona to California to Chihuahua and Baja California (Map 1).

*Metepeira crassipes* Chamberlin and Ivie  
Plate 3; Figures 47–52; Map 1

*Metepeira josepha* Chamberlin and Ivie, 1942, Bull. Univ. Utah, biol. ser., 7(1): 64, fig. 165, ♀. Female holotype from Kings Mtn. near Palo Alto, California in the American Museum of Natural History, examined. NEW SYNONYMY.

*Metepeira crassipes* Chamberlin and Ivie, 1942, Bull. Univ. Utah, biol. ser., 7(1): 66, figs. 171–173, ♀, ♂. Male holotype, female, male para-

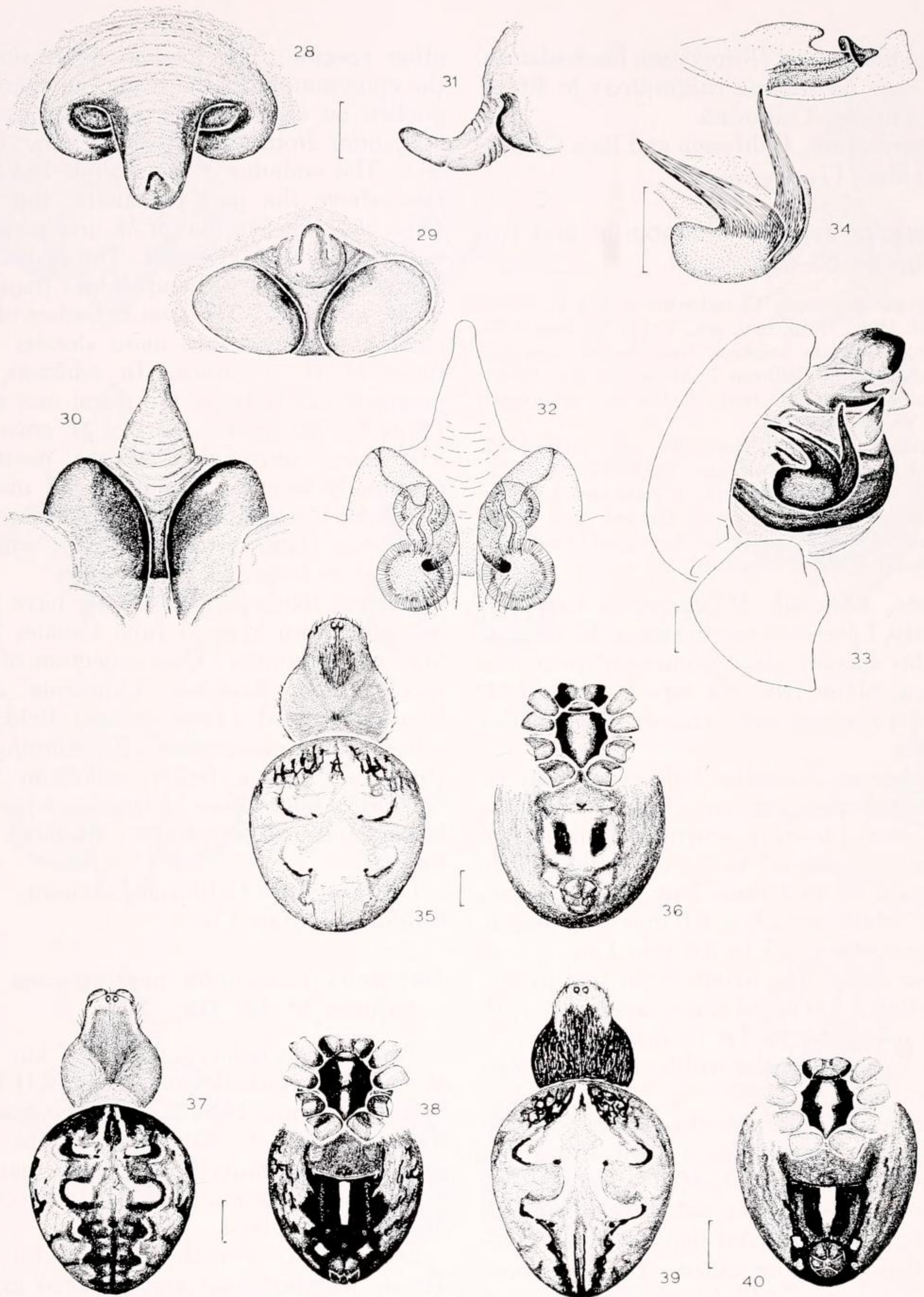
types from Laguna Beach, California in the American Museum of Natural History, examined.

*Note.* Although *M. josepha* has a page priority, as first revisor I prefer to use *M. crassipes* since the male is the type and several specimens are available from the type locality.

*Variation.* The white sternal band may be broken as in *M. grinnelli*. The height of the base of the median apophysis is variable. Total length of females 4.9 to 7.2 mm, carapace 2.2 to 3.2 mm long, 1.7 to 2.3 mm wide. Total length of males 2.9 to 4.7 mm, carapace 1.6 to 2.3 mm long, 1.2 to 1.7 mm wide. The first patella and tibia is 1.0 to 1.2 times the carapace length in females, 1.1 to 1.3 times in males.

*Diagnosis.* Although sizes overlap, this species is noticeably smaller than *M. grinnelli* when collected with it. Females can be separated from *M. grinnelli* by the shorter scape having a slight constriction (Figs. 47, 49) and from both *M. grinnelli* and *M. ventura* by the smaller depression on each side of the scape (Fig. 47). The females differ from *M. arizonica* in that the side of the base of the epigynum, which is visible on each side of the scape, is wider than the scape itself (Fig. 47). While females can be confused with *M. arizonica*, males are more likely to be mistaken for *M. ventura*. Differences, however, can be detected. Males of this species have both flagella of the median apophysis subequal in length (Figs. 51, 52), while those of *M. ventura* are quite unequal. The space surrounded by the proximal, posteriorly directed flagellum and by the base of the median apophysis is equal or larger than the area of the median apophysis (below it in Figs. 51, 52), while it is smaller in *M. ventura*. The embolus has a much shorter distal duct-bearing portion (Figs. 51, 52) than that of *M. arizonica*, and the terminal apophysis (Fig. 51) appears to be smaller than that of *M. ventura*.

*Natural History.* Males have been collected from April to October. A large number of specimens were collected from Cali-



Figures 28-36. *Metepeira gosoga* Chamberlin and Ivie. 28-32. Epigynum: 28. Ventral. 29. Posteroventral. 30. Posterior. 31. Lateral. 32. Posterior, cleared. 33. Left male palpus, mesal. 34. Median apophysis and embolus. 35. Female, dorsal. 36. Female, ventral.

Figures 37, 38. *M. grinnelli* (Coolidge). 37. Female, dorsal. 38. Female, ventral.

Figures 39, 40. *M. arizonica* Chamberlin and Ivie. 39. Female, dorsal. 40. Female, ventral.

Scale lines. 0.1 mm except Figs. 35-40, 1.0 mm.

ifornia buckwheat (*Eriogonum fasciculatum*) and sage (*Artemisia californica*) in Riverside County, California.

*Distribution.* California and Baja California (Map 1).

*Metepeira ventura* Chamberlin and Ivie  
Figures 53–60; Map 1

*Metepeira ensinada* Chamberlin and Ivie, 1942, Bull. Univ. Utah, biol. ser., 7(1): 65, figs. 166–168, ♂. Male holotype from beach near Ensenada [Baja California], Mexico in the American Museum of Natural History, examined. NEW SYNONYMY.

*Metepeira ventura* Chamberlin and Ivie, 1942, Bull. Univ. Utah, biol. ser., 7(1): 67, figs. 175–179, ♀. Female holotype, 1 male and 3 female paratypes from between Oxnard and Santa Monica, California, in the American Museum of Natural History, examined.

*Note.* Although *M. ensinada* has page priority, I prefer to use the name *M. ventura* for this species. since numerous specimens were available from the type locality of *M. ventura* that are more characteristic of this species.

*Variation.* A median light streak may be present on the carapace (Fig. 59) and the light sternal band is sometimes broken. Females are from 4.7 to 7.4 mm total length, carapace 2.4 to 2.9 mm long, 1.6 to 2.4 mm wide. Males are 2.6 to 6.0 mm total length, carapace from 1.5 to 3.0 mm long, 1.0 to 2.3 mm wide. The length of the first patella and tibia is 1.0 to 1.3 times carapace length in females, 1.4 to 1.6 in males. There is some variation in the width of the epigynal scape.

*Diagnosis.* The middle of the posterior head region often has a light streak not found in *M. grinnelli*, *M. crassipes* or *M. arizonica*, but this is not always present. The light sternal band may be broken, unlike that of *M. arizonica*. The epigynum of *M. ventura* usually has a much narrower scape (Figs. 53–56) than the sympatric *M. crassipes*, *M. grinnelli*, *M. arizonica* and *M. gosoga*, and the depression to the sides of the scape are wider with the posterior rim narrower (Fig. 53) than that of the

other species. The median depression of the epigynum faces the scape but there are pockets on each side as seen in a cleared epigynum from the posterior view (Fig. 56). The embolus of the palpus lacks the lobe above the part containing the duct (Fig. 58), just like that of *M. arizonica* and unlike that of *M. grinnelli*. The embolus is less gracefully curved and shorter than that of *M. arizonica*. The two branches of the median apophysis are more slender than those of *M. arizonica*. In addition, the proximal one is large, the distal one small (Figs. 57, 58), unlike those of *M. crassipes*. The space surrounded by the proximal, posteriorly directed flagellum and median apophysis is less than the area of the median apophysis (below it in Fig. 57), while it is equal or larger in *M. crassipes*.

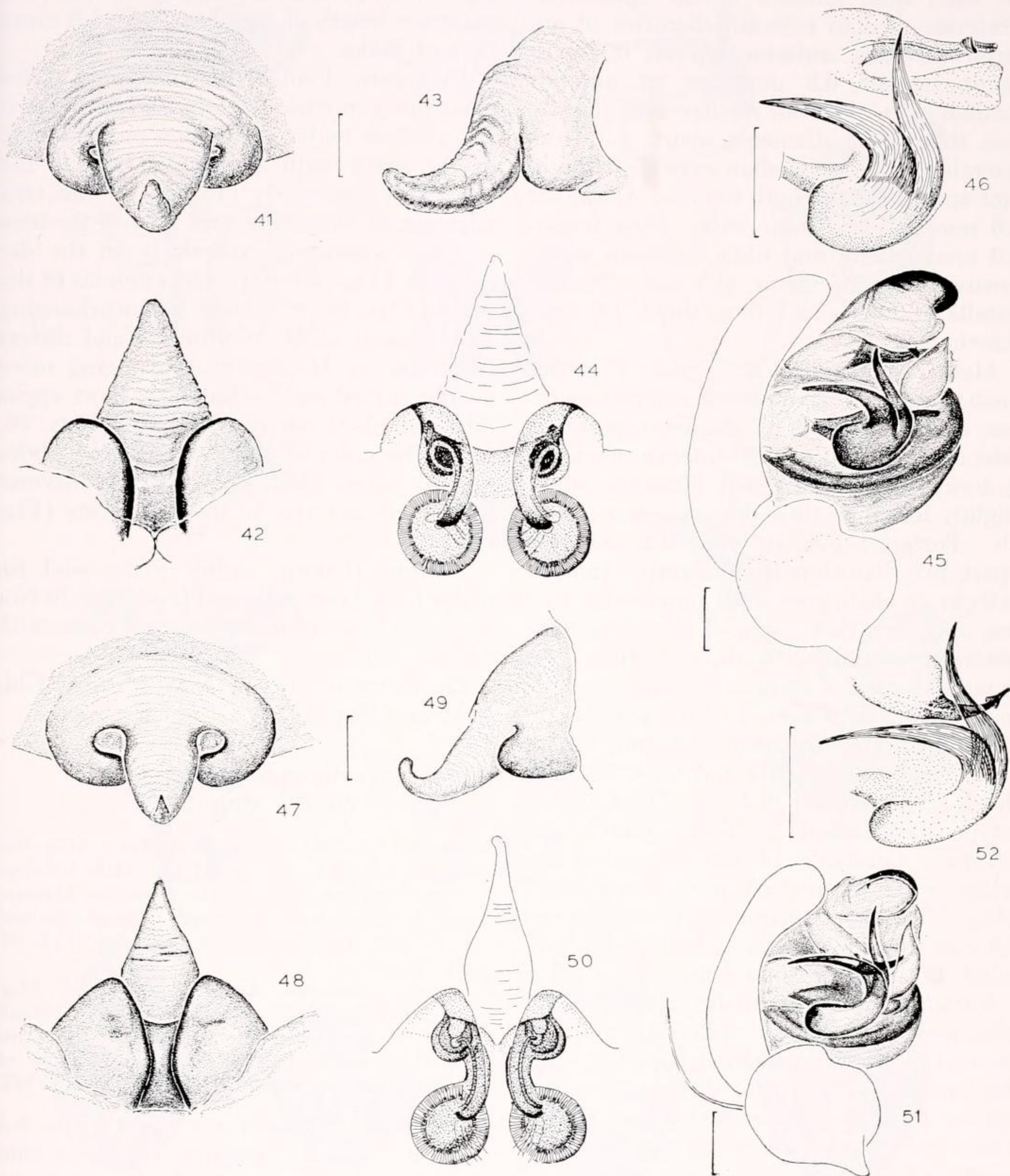
*Natural History.* Adult males have been collected from May to July, females from May to September. One collection of this species from Lompoc, California came from a mustard (Brassicaceae) field, another from manzanita (*Arctostaphylos*) chaparral, and a larger collection from California buckwheat (*Eriogonum fasciculatum*) and California sage (*Artemisia californica*).

*Distribution.* California, Sonora, Baja California (Map 1).

*Metepeira comanche* new species  
Figures 61–69; Map 1

*Type.* Male holotype from 9.7 km west of O'Brien, Haskell Co., Texas, 3.II.1971, from the annual legume guar (*Cyamopsis tetragonolopa*), C. E. Rogers, in the Museum of Comparative Zoology. The name is a noun in apposition after the Indian tribe of the Texas plains.

*Description.* Female from Webb Co., Texas. Anterior light area of head grades gradually into dark area posteriorly (Fig. 68). A median light streak in many specimens just anterior to thoracic depression. Legs banded. Dorsum of abdomen with usual folium; posteriorly, venter often with white transverse bar connecting with longi-



Figures 41-46. *Metepeira arizonica* Chamberlin and Ivie. 41-44. Epigynum: 41. Ventral. 42. Posterior. 43. Lateral. 44. Posterior, cleared. 45. Left male palpus, mesal. 46. Median apophysis and embolus.

Figures 47-52. *M. crassipes* Chamberlin and Ivie. 47-50. Epigynum: 47. Ventral. 48. Posterior. 49. Lateral. 50. Posterior, cleared. 51. Male palpus, mesal. 52. Median apophysis and embolus.

Scale lines. 0.1 mm.

tudinal mark (Fig. 69). There is one spot on each side, anterior to the spinnerets. Posterior median eyes 0.8 diameter of anterior medians, anterior laterals 0.7, posterior laterals 0.8 diameter of anterior median eyes. Anterior median eyes slightly less than their diameter apart, 1.3 from laterals. Posterior median eyes their diameter apart. Total length 6.5 mm. Carapace 2.6 mm long, 2.2 mm wide. First femur, 2.9 mm; patella and tibia, 3.2 mm; metatarsus, 2.9 mm; tarsus, 0.5 mm. Second patella and tibia, 2.7 mm; third, 1.6 mm; fourth, 2.2 mm.

Male from Wells Co., Texas. Posterior median eyes 0.7 diameter of anterior medians, anterior laterals 0.7 diameter, posterior laterals 0.6 diameter of anterior medians. Anterior median eyes 0.6 diameter apart, slightly less than their diameter from laterals. Posterior median eyes 0.5 diameter apart, two diameters from laterals. Anterior margin of chelicerae with four teeth, first one and then three, spaced close together; posterior margin with three teeth. Total length 4.7 mm. Carapace 2.3 mm long, 1.7 mm wide. First femur, 3.2 mm; patella and tibia, 3.4 mm; metatarsus, 3.2 mm; tarsus, 1.1 mm. Second patella and tibia, 2.8 mm; third, 1.6 mm; fourth, 2.2 mm. The male holotype from Haskell Co., Texas: total length 3.0 mm. Carapace 1.6 mm long, 1.2 mm wide. First femur, 2.5 mm; patella and tibia, 2.3 mm; metatarsus, 2.1 mm; tarsus, 0.8 mm. Second patella and tibia, 1.9 mm; third, 1.0 mm; fourth, 1.4 mm.

*Variation.* No two males are the same size and even males collected together seemed to vary tremendously in size. With this variation in size come differences in the macrosetae: the smaller males have fewer. There are also differences in the palpus of small and large specimens but not in the shape of the sclerotized median apophysis and embolus. The white sternal line may be broken. Females are from 4.5 to 7.2 mm total length, carapace 2.2 to 3.2 mm long, 1.8 to 2.4 mm wide. Males are 3.2 to 5.2 mm total length, carapace 1.8 to 2.4

mm long, 1.5 to 1.9 mm wide. The length of the first patella and tibia is 1.1 times the carapace length of females, 1.3 to 1.6 times that of males.

*Diagnosis.* Female *M. comanche* differ from the sympatric *M. labyrinthea* by having a much wider depression on each side of the scape with a narrower rim to the sides and posteriorly (Fig. 61). The area adjacent to the scape and part of its base is wide, extending posteriorly in the depression (Figs. 61, 62). The embolus of the male (Figs. 66, 67) lacks the overhanging lobe present in *M. labyrinthea* and differs from that of *M. arizonica* by being more evenly curved and by having a short upper lobe, which is not overhanging (Figs. 66, 67). The color of the venter of the abdomen is often light, showing a transverse light mark anterior to the spinnerets (Fig. 69).

*Natural History.* Adult males and females have been collected from May to November. None of the collections come with habitat data.

*Distribution.* Texas, New Mexico, Chihuahua (Map 1).

### *Metepeira minima* Gertsch

Figures 70–77; Map 1

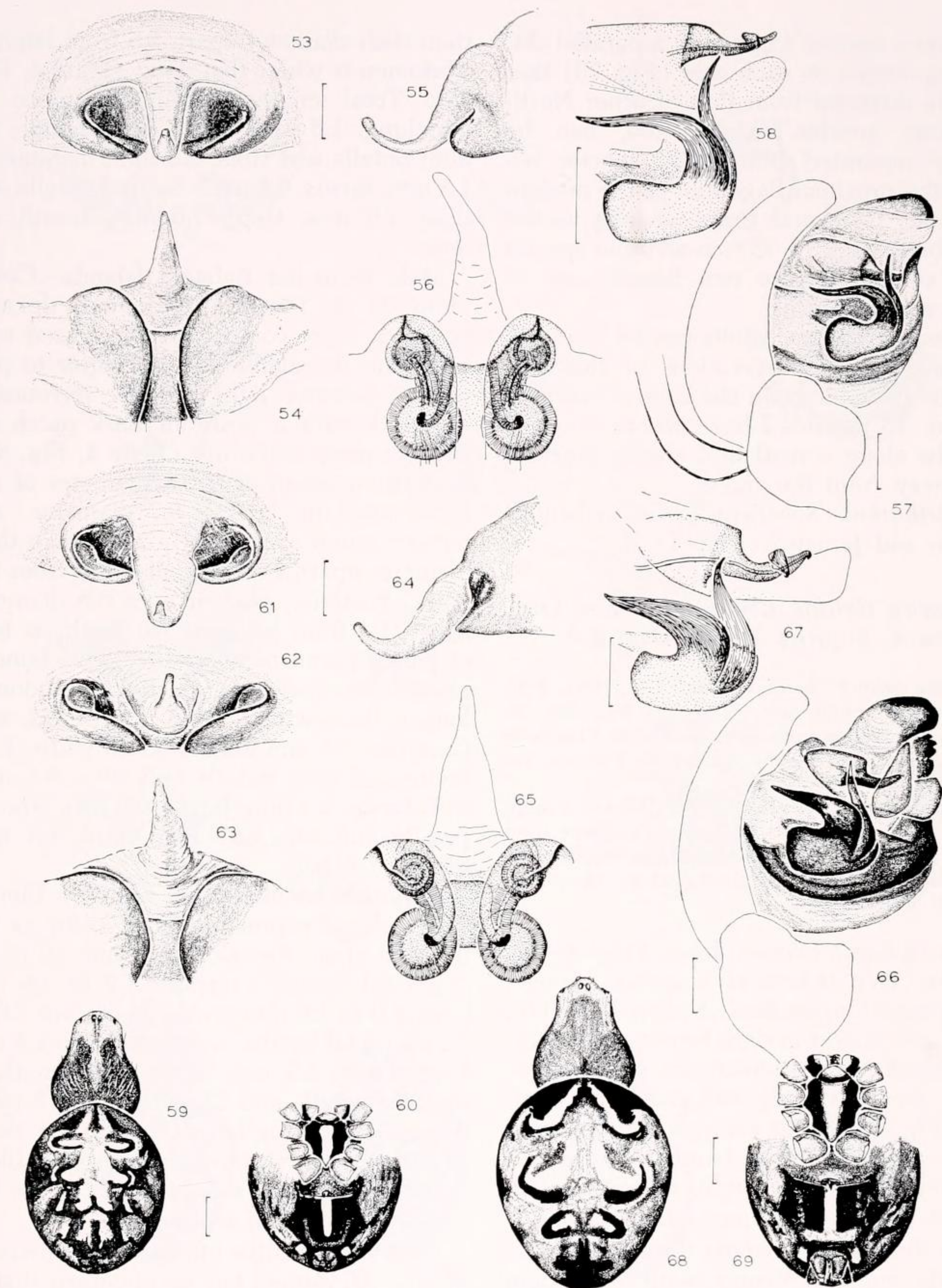
*Metepeira minima* Gertsch, 1936, Amer. Mus. Novitates, no. 852: 10, fig. 31, ♂. Male holotype from Edinburg, Texas in the American Museum of Natural History, examined. Chamberlin and Ivie, 1942, Bull. Univ. Utah, biol. ser., 7(1): 67, fig. 174, ♀.

*Metepeira jamaicensis* Archer, 1958, Amer. Mus. Novitates, no. 1922: 16, fig. 33, ♀. Female holotype from Port Henderson, St. Catherine Parish, Jamaica, in the American Museum of Natural History, examined. NEW SYNONYMY.

*Variation.* Females are from 4.5 to 6.5 mm total length, carapace 1.9 to 2.6 mm long, 1.4 to 2.2 mm wide. Males are 2.6 to 4.2 mm total length, carapace from 1.3 to 2.7 mm long, 0.9 to 1.6 mm wide. The length of the first patella and tibia is 1.1 times carapace length in females, 1.4 times in males.

*Diagnosis.* The female *M. minima* epigy-





Figures 53-60. *Metepeira ventura* Chamberlin and Ivie. 53-56. Epigynum: 53. Ventral. 54. Posterior. 55. Lateral. 56. Posterior, cleared. 57. Left male palpus, mesal. 58. Median apophysis and embolus. 59. Female, dorsal. 60. Female, ventral.

Figures 61-69. *M. comanche* n. sp. 61-65. Epigynum: 61. Ventral. 62. Posteroventral. 63. Posterior. 64. Lateral. 65. Posterior, cleared. 66. Male palpus, mesal view. 67. Median apophysis and embolus. 68. Female, dorsal. 69. Female, ventral.

Scale lines. 0.1 mm except Figs. 59, 60, 68, 69, 1.0 mm.

num has a narrow scape with a parallel slit-like depression on each side (Fig. 70) that is quite different from that of other North American species. Males, too, can be readily separated from other species because the proximal flagellum of the median apophysis is several times as long as the distal one (Figs. 74, 75); in all other species north of Mexico the two flagella are of about equal length.

*Natural History.* Adults can be found in all seasons. No observations of this species are available from the United States or Mexico. In Jamaica I have observed adults in webs along a road in a shady situation and away from the shore.

*Distribution.* Southern Texas, to central Mexico and Jamaica (Map 1).

*Metepeira datona* Chamberlin and Ivie  
Plate 4; Figures 78–86; Map 2

*Metepeira datona* Chamberlin and Ivie, 1942, Bull. Univ. Utah, biol. ser., 7(1): 68, fig. 196, ♀. Female holotype from Daytona Beach, Florida in the American Museum of Natural History, examined.

*Metepeira inerma* Bryant, 1945, Bull. Mus. Comp. Zool., 95: 378, fig. 20, ♀. Female holotype from Cap Haitien, Haiti in poor physical condition in the Museum of Comparative Zoology, examined.  
NEW SYNONYMY.

*Description.* Female from Flagler Co., Florida. Eye region of carapace orange; and orange longitudinal median line (Fig. 85). Lateral eyes in dark brown area. Sternum black-brown, sometimes with lighter brown area anteriorly and another posteriorly (Fig. 86). Legs are yellow-white with narrow, dark broken bands on dorsum. Dorsum of abdomen light anteriorly with a black posterior folium. Sides black distinctly delineated towards dorsum, but not towards venter. Venter with a median white spot on black. Posterior median eyes subequal to anterior medians. Anterior and posterior laterals 0.8 diameter of anterior median eyes. Anterior median eyes 1.2 diameters apart, 1 diameter from laterals. Posterior median eyes slightly less

than their diameter apart, 2.5 from laterals. Abdomen is wider than long (Plate 4; Fig. 85). Total length 3.9 mm. Carapace 1.8 mm long, 1.5 mm wide. First femur, 2.2 mm; patella and tibia, 2.3 mm; metatarsus, 1.5 mm; tarsus, 0.6 mm. Second patella and tibia, 1.9 mm; third, 1.0 mm; fourth, 1.7 mm.

Male from the Bahama Islands. Coloration as in female. Abdomen, dorsum, however, more conservatively colored with a median dorsal line from anterior to posterior. Anterior light patches surrounded by black with a posterior dark patch extending more anteriorly (Plate 4; Fig. 85). Posterior median eyes 0.8 diameter of anterior medians, laterals 0.7 diameter. Anterior median eyes slightly more than their diameter apart, the same distance from laterals. Posterior median eyes 0.6 diameter apart, 1.5 from laterals. No tooth on base of palpal femur or on endite. Two femoral macrosetae and two on tibia. Abdomen longer than wide. Total length 3.2 mm. Carapace 1.8 mm long, 1.5 mm wide. First femur, 3.2 mm; patella and tibia, 3.5 mm; metatarsus, 2.4 mm; tarsus, 0.9 mm. Second patella and tibia, 2.7 mm; third, 1.3 mm; fourth, 1.8 mm.

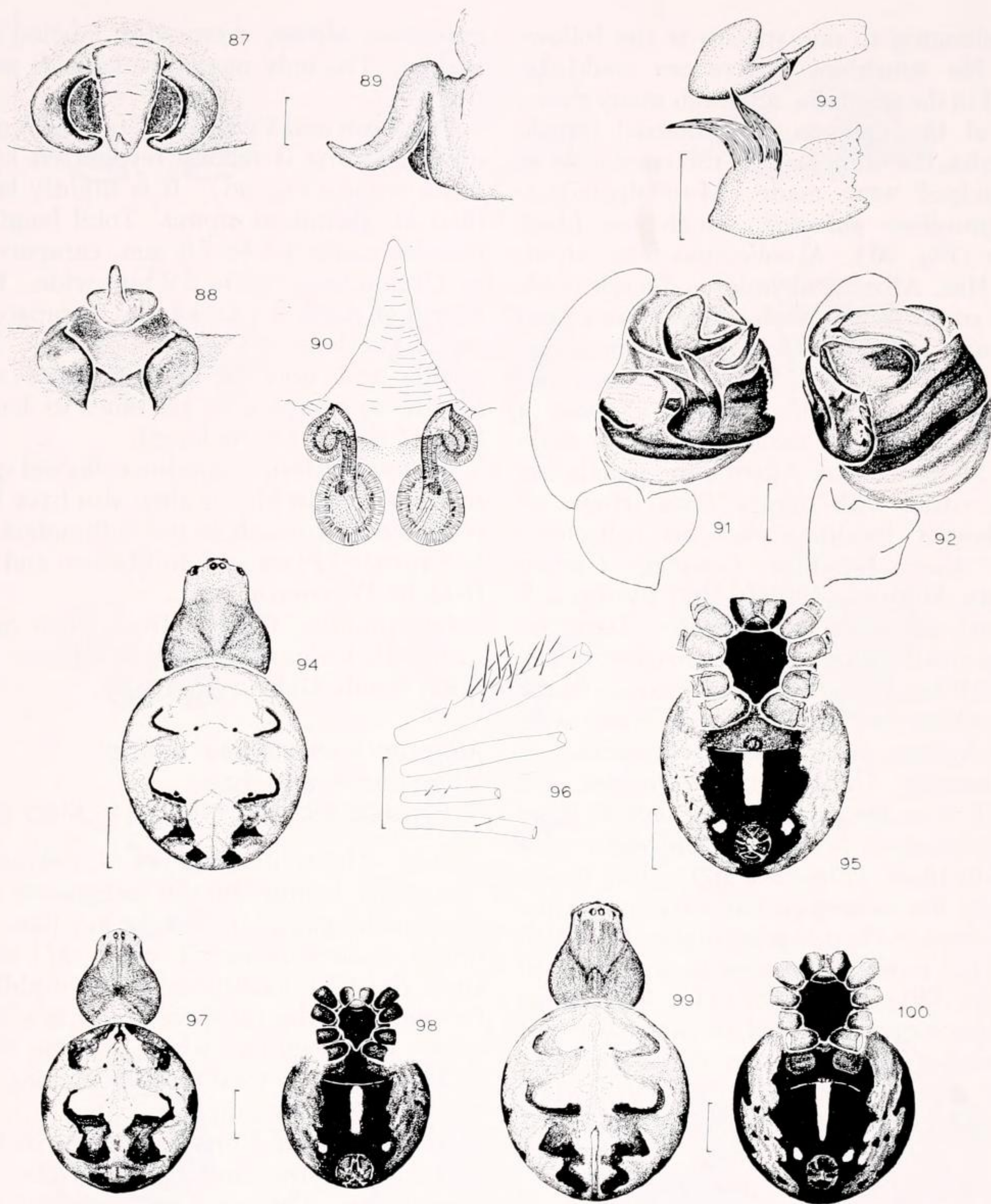
*Variation.* A male from southern Florida had the eye region the same color as the thoracic area. Females are from 2.6 to 4.6 mm total length, carapace 1.2 to 1.8 mm long, 1.0 to 1.6 mm wide. Males are 2.0 to 3.2 mm total length, carapace 1.0 to 1.8 mm long, 0.9 to 1.5 mm wide. The length of the first patella and tibia is 1.1 to 1.3 times the carapace length in females, 1.9 times in males. The sternum is brownish black and sometimes has a lighter area in the anterior and posterior sections.

*Diagnosis.* Unlike other North American species, *M. datona* has an abdomen that is wider and more spherical than it is long; the anterior of the dorsum has a light patch framed by black (Figs. 85, 86). It differs, of course, from small *Araneus* species of a similar color, by the ventral median longitudinal white stripe on the abdomen (Fig.



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Figures 87-96. *Metepeira foxi* Gertsch and Ivie. 87-90. Epigynum: 87. Ventral. 88. Posterior. 89. Lateral. 90. Posterior, cleared. 91-93. Left male palpus: 91. Mesal. 92. Ventral. 93. Median apophysis and embolus. 94. Female, dorsal. 95. Female, ventral. 96. Left male femora, ventral.

Figures 97, 98. *M. grandiosa palustris* Chamberlin and Ivie, juvenile (Nova Scotia). 97. Dorsal. 98. Ventral.

Figures 99, 100. *M. grandiosa alpina* Chamberlin and Ivie, female (northern Arizona). 99. Dorsal. 100. Ventral.

Scale lines. 0.1 mm except Figs. 94-100, 1.0 mm.

type and numerous female paratypes from Fish Lake, Utah, in American Museum of Natural History, examined. NEW SYNONYMY.

*Subspecies.* The variation of this species

is so distinct that I use subspecific names; *palustris* for the eastern and northern, *alpina* for the Rocky Mountain and *grandiosa* for the Pacific subspecies. Evidence for

all belonging to one species is the following. No consistent differences could be found in the genitalia, although many drawings of the epigyna, the internal female genitalia, the embolus and the conductor of the palpus were made. Most distinct is *M. grandiosa palustris*, which has black coxae (Fig. 98). A collection from Medicine Hat, Alberta includes a female with black coxae, a male with yellow coxae; from Stockade Lake, Custer County, South Dakota one female has black coxae, another yellow; from Greeley County, Kansas a female has yellow coxae with some dark; from Medicine Hat, Alberta one female has black coxae with orange distal rings; all are border localities. Several collections from East Rosebud Canyon, Carbon County, Montana, 1963 to 1967 (Vogel collection) are also intermediate: large females, small males, variously marked coxae, some all black, some with two coxae black, two yellow on each side and some with coxae having yellow and black marks.

*Diagnosis.* Unlike most *Metepeira*, but like *M. foxi*, the median longitudinal band of the sternum is missing, the sternum is entirely black (Figs. 98, 100). But unlike *M. foxi*, the epigynum has a transverse depression on each side posteriorly (Figs. 101, 106, 112) in which the openings are located laterally (Figs. 103, 108, 114). The palpal embolus is evenly curved, the narrower part at about a right angle to the wider base (Figs. 104, 105, 109, 111, 115, 116), while that of *M. foxi* is at about a 45° angle.

### *Metepeira grandiosa palustris*

Chamberlin and Ivie

Figures 97, 98, 101–105; Map 2

*Note.* Emerton's bog variety of *M. labyrinthea* was this subspecies, although some specimens in the collections from Mount Lincoln, Colorado, considered here to be

*grandiosa alpina*, were also labeled bog variety. The only name available is *palustris*.

*Diagnosis and Variation.* *Metepeira grandiosa palustris* is readily recognized by its black coxae (Fig. 98). It is slightly larger than *M. grandiosa alpina*. Total length of females varies 4.7 to 7.6 mm, carapace 1.9 to 2.9 mm long, 1.6 to 2.2 mm wide. Total length of males 3.1 to 3.8 mm, carapace 1.7 to 1.9 mm long, 1.4 to 1.5 mm wide. First patella and tibia of female is the same length as carapace to 1.2 times its length; that of males, 1.5 its length.

*Natural History.* Emerton collected specimens in bogs in Maine; they also have been collected in a marsh in the Adirondacks, in low spruce (*Picea* sp.) in Quebec and in a field in Wisconsin.

*Distribution.* Canada from Nova Scotia to British Columbia, south to Maine, New York, South Dakota (Map 2).

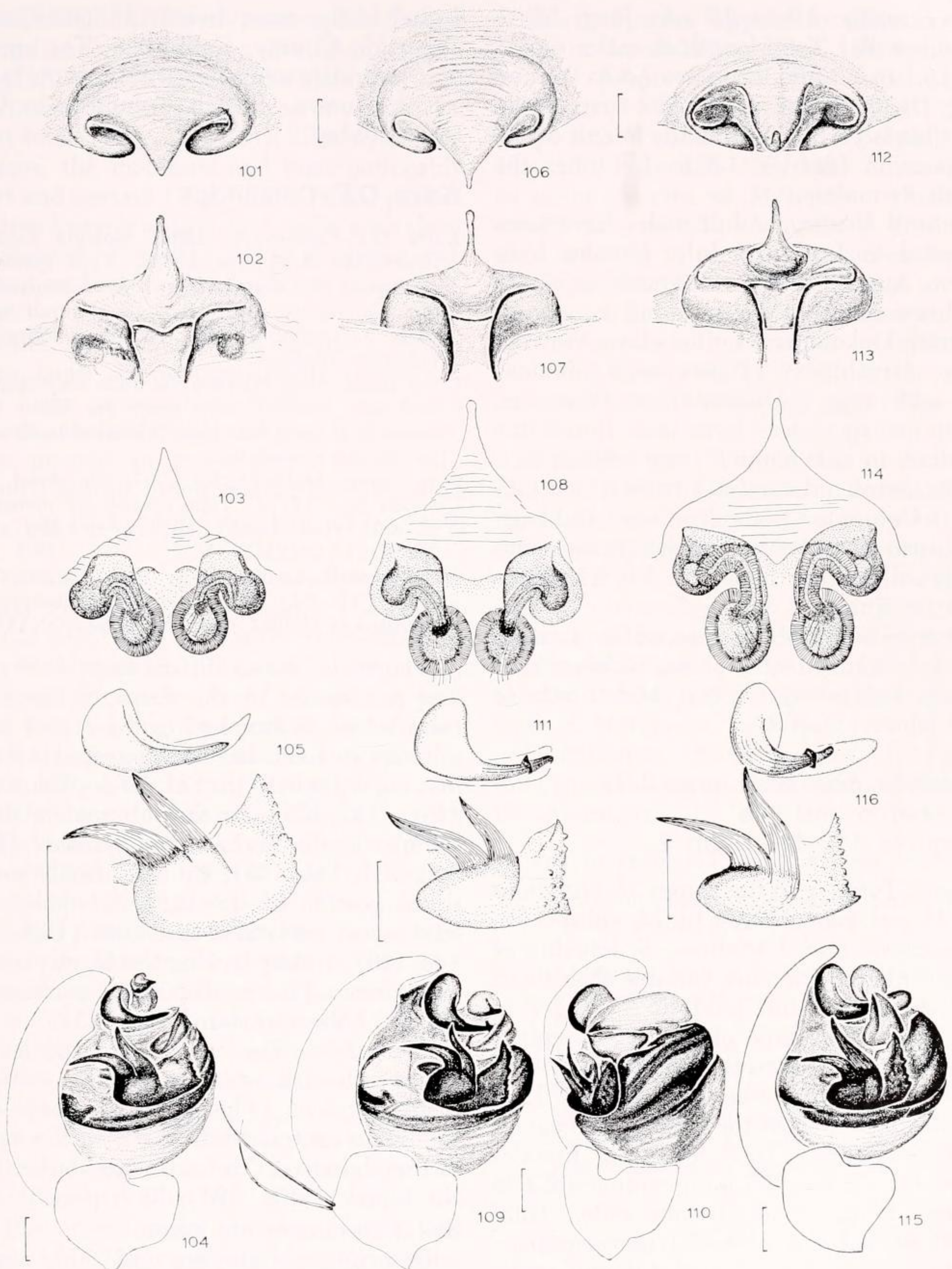
### *Metepeira grandiosa alpina*

Chamberlin and Ivie

Figures 99, 100, 106–111; Map 2

*Note.* The types of names *M. dakota* and *M. alpina* belong to this subspecies. Although the name *M. dakota* has page priority, as first revisor I chose *M. alpina* since the type locality is in the middle of the range of the subspecies and is a place where it is common, while Noonan, North Dakota, the type locality of *M. dakota*, is at the border of the range.

*Diagnosis and Variation.* This includes the smallest sizes and the most abundant populations. The scape of the epigynum is wide at the base (Fig. 106) and the palpal embolus is intermediate in length (Fig. 111). The coxae are never black, but intermediates are found among the eastern-most specimens (see *M. grandiosa palustris*). Total length of females is from 4.0 to 6.8



Figures 106–111. *M. grandiosa alpina* Chamberlin and Ivie (northern Arizona). 106–108. Epigynum: 106. Ventral. 107. Posterior. 108. Posterior, cleared. 109. Male palpus, mesal. 110. Palpus, ventral. 111. Median apophysis and embolus.

Figures 112–116. *M. grandiosa grandiosa* Chamberlin and Ivie (Riverside Co., California). 112–114. Epigynum: 112. Ventral. 113. Posterior. 114. Posterior, cleared. 115. Male palpus, mesal. 116. Median apophysis and embolus.

Scale lines. 0.1 mm.



mm, carapace 1.9 to 2.9 mm long, 1.5 to 2.2 mm wide. Total length of males ranges from 3.1 to 5.3 mm, carapace 1.8 to 2.4 mm long, 1.4 to 1.8 mm wide. The first patella and tibia is 1.0 to 1.5 times the length of the carapace in females, 1.5 to 1.7 times the length in males.

*Natural History.* Adult males have been collected in June and July, females from June to August. *Metepeira grandiosa alpina* has been collected by sweeping a meadow in South Dakota, from a meadow, browsed aspen, bunchgrass (?*Sporobolus airoides*) and with sage (*Artemisia*) in Wyoming. Additional specimens have been found in a meadow, in oak juniper (two collections), on sagebrush (*Artemisia*) from a dry hillside in Colorado (two collections) and from sagebrush in Oregon. Specimens are commonly collected with *M. foxi*. Their habitats must be similar.

*Distribution.* Rocky Mountain area of Saskatchewan, North Dakota, Oklahoma, to British Columbia, Oregon and south to Chihuahua (Map 2).

### *Metepeira grandiosa grandiosa*

Chamberlin and Ivie

Figures 112–116; Map 2

*Note.* Types with the names *M. grandiosa* and *M. palomara* belong to this subspecies.

*Diagnosis and Variation.* Specimens of this subspecies are more variable than those of *M. g. alpina* but tend to be larger in size. Often the scape of the female epigynum is narrower than that of the other subspecies; it has a median ridge (Fig. 112) and the distal part of the embolus is heavier (Figs. 115–116). Total length of females varies from 5.4 to 8.5 mm, carapace 2.3 to 3.5 mm long, 1.9 to 3.0 mm wide. Total length of males is 3.5 to 5.1 mm, carapace 1.9 to 2.7 mm long, 1.4 to 1.9 mm wide. First patella and tibia of female is 1.3 times the length of the carapace, that of the male, 1.3 to 1.8 times.

*Natural History.* Males have been collected from March to October, females from April to September. They have been col-

lected in the same area as *M. crassipes*, in Riverside County, California. The species was abundant only in spring, not in fall.

*Distribution.* British Columbia to California (Map 2).

### *Kaira* O.P.-Cambridge

*Kaira* O.P.-Cambridge, 1889, *Biologia Centrali-Americana, Araneidea*, 1: 56. Type species *K. gibberosa* O.P.-Cambridge, 1889 designated by F.P.-Cambridge, 1904, *Biologia Centrali-Americana, Araneidea*, 2: 522. The name *Kaira* is of feminine gender.

*Caira* Simon, 1895, *Histoire Naturelle des Araignées*, 2nd ed., 1: 894. New name for *Kaira* (presumably because the Latin alphabet lacks a K), an invalid emendation.

*Pronarachne* Mello-Leitão, 1937, *An. Acad. Brasileira Sci.*, 11: 9. Type species by monotypy, *P. aries* Mello-Leitão, 1937 (? = *Kaira alba*). NEW SYNONYMY.

*Macpos* Mello-Leitão, 1969, *Rev. Chilena Hist. Natur.* 43: 59. Type species by monotypy, *M. monstrosus* Mello-Leitão. NEW SYNONYMY.

*Diagnosis.* *Kaira* differs from *Metepeira* and *Aculepeira* by the shape of the abdomen, which is attached in the center of its anterior side and has the longest axis almost at a right angle to that of the cephalothorax (Figs. 123, 125); by the tuberculate dorsal humps on the abdomen of females (Figs. 122, 134, 144, 146); by the heavily armed distal portion of the legs of females that have short metatarsi and tarsi (Figs. 122, 144, 146); and by lacking the black pigmentation around the median white mark on the venter of the abdomen (Fig. 123).

*Coloration.* The color of all species appears yellowish white, with only scattered black pigment (Figs. 122, 126, 144–146); there is a central white mark on the venter of the abdomen. The males are darker than the females (Fig. 126). It is possible that living specimens are green.

*Description.* Carapace noticeably narrow in the head region (Figs. 121, 122, 126). Chelicerae armed with three long teeth on the anterior margin (one of the three slightly shorter than the others) and with two denticles on the posterior margin (Fig. 121). Endites short, unlike those of *Met-*

*peira*. Height of the clypeus equals that of the anterior median eyes or slightly higher (Fig. 121). Abdomen higher than long, has tuberculate dorsal humps and covered with short setae (Figs. 122, 123). Tibiae slightly sinuous; the metatarsi and tarsi noticeably short and curved (Fig. 123). Distal part of the legs heavily armed, in *K. alba* with short macrosetae (Fig. 121) and in *K. sabino* with both short and long macrosetae (Figs. 144, 146).

Males are smaller than females. Palpal femur lacks the proximal tooth; palpal patella lacks macrosetae. Neither coxae nor legs of males modified; and they lack macrosetae present in the female. Male's abdominal humps much smaller than female's and may not be tuberculate (Figs. 126, 135, 138).

*Genitalia*. The genitalia are surprisingly similar to those of *Metepeira*. The epigynum is small and as weakly sclerotized as that of *Metepeira* (Figs. 117, 130, 141); the openings are on each side of the posterior face leading into pockets that funnel into the large spherical seminal receptacles (Figs. 120, 123, 143). The palpus has a strongly sclerotized median apophysis with a distal row of teeth and two flagella (Figs. 127-129, 136, 137, 139, 140) similar to that of some species of *Metepeira*. The embolus (e in Fig. 129), as in *Metepeira*, has a lobe below the duct-bearing portion. A long terminal apophysis (a) is separated from the embolus by a distal hematodocha (dh in Fig. 129). It is not known if the virgin embolus has a cap that is transferred to the female when mating.

*Natural History*. Nothing is known of habits; the species are so rare that one can only speculate what the habits might be. Do the armed distal articles of the legs (Figs. 122, 123) indicate that the spider does not make a web, but instead catches insects with the legs in a crabspider fashion, as do some other Araneidae?

*Species*. There are so few specimens in collections that it is difficult to decide the limits of species and to match males and

females. Species appear to differ by the shape of the abdomen (Figs. 124, 134, 145), by the proportions of the scape of the epigynum (Figs. 118, 131, 141) and by the shape of the conductor of the palpus (c in Fig. 129, Figs. 128, 137, 140) (in contrast to many species of *Metepeira* where the conductors resemble each other). It is probably not safe to identify specimens by abdominal humps alone. The humps of two females of *K. sabino* are very different. The reason for this is that one has probably just molted (Figs. 146, 147), while the other has very recently produced eggs (Figs. 144, 145).

*Relationships*. The genitalia of *Kaira* resemble *Metepeira* to such an extent that a common ancestor should be assumed. Another similarity is the white spot on the venter of the abdomen. *Kaira* shares the closest relationship with the *M. foxi* group, which also has teeth on the distal keel of the median apophysis (m in Fig. 129). I considered the *M. foxi* group the least specialized of *Metepeira*.

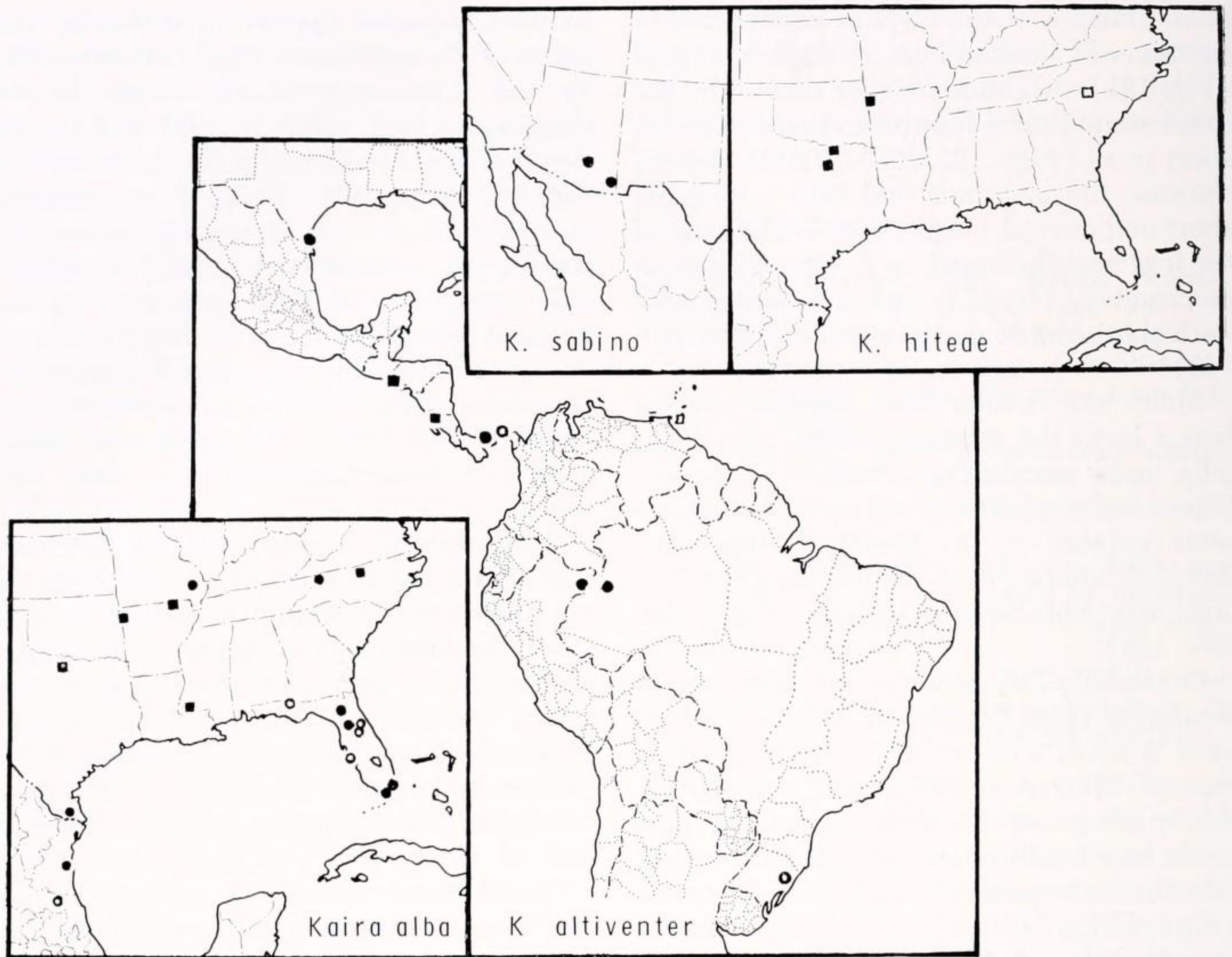
*Distribution*. *Kaira* species are known only from the warmer and tropical parts of the Americas.

KEY TO FEMALE *KAIRA* NORTH OF MEXICO

- 1. Epigynum with a longitudinal, longer than wide, transparent keel or hook (Figs. 117, 130) ..... 2
- Epigynum with a transverse, wider than long, transparent scape (Fig. 141); Arizona (Map 3) ..... *sabino*
- 2(1) Epigynum having a hook-shaped scape (Fig. 132); southern Texas to South America (Map 3) ..... *altiventer*
- Epigynum having a keel-shaped scape, of variable profile (Fig. 119); North Carolina and Missouri to northeastern Mexico (Map 3) ..... *alba*

KEY TO MALE *KAIRA* NORTH OF MEXICO

- 1. Palpus with a light swelling on distal end of conductor, conductor without proximal pocket (Figs. 128, 129, 137); terminal apophysis sharply pointed (Figs. 127, 129, 136) ..... 2
- Conductor with a dark distal swelling overhanging subdivided lateral pockets (Fig. 140); terminal apophysis bluntly pointed



Map 3. Distribution of *Kaira* species found north of Mexico. Circles, females; open circles, juvenile specimens; squares, males; open squares, juvenile males.

- (Fig. 139); ? South Carolina, Arkansas, northern Texas (Map 3) ..... *hiteae*
- 2(1) Proximal flagellum of median apophysis longer than distal one (Figs. 127, 128); tip of conductor pointed mesally, toward median apophysis (Fig. 128); North Carolina and Missouri to northeastern Mexico (Map 3) ..... *alba*
- Flagella of median apophysis equal in length (Figs. 136, 137); tip of conductor pointed laterally, away from median apophysis (Fig. 137); Texas to South America (Map 3) ..... *altiventer*

*Kaira alba* (Hentz)

Figures 117–129; Map 3

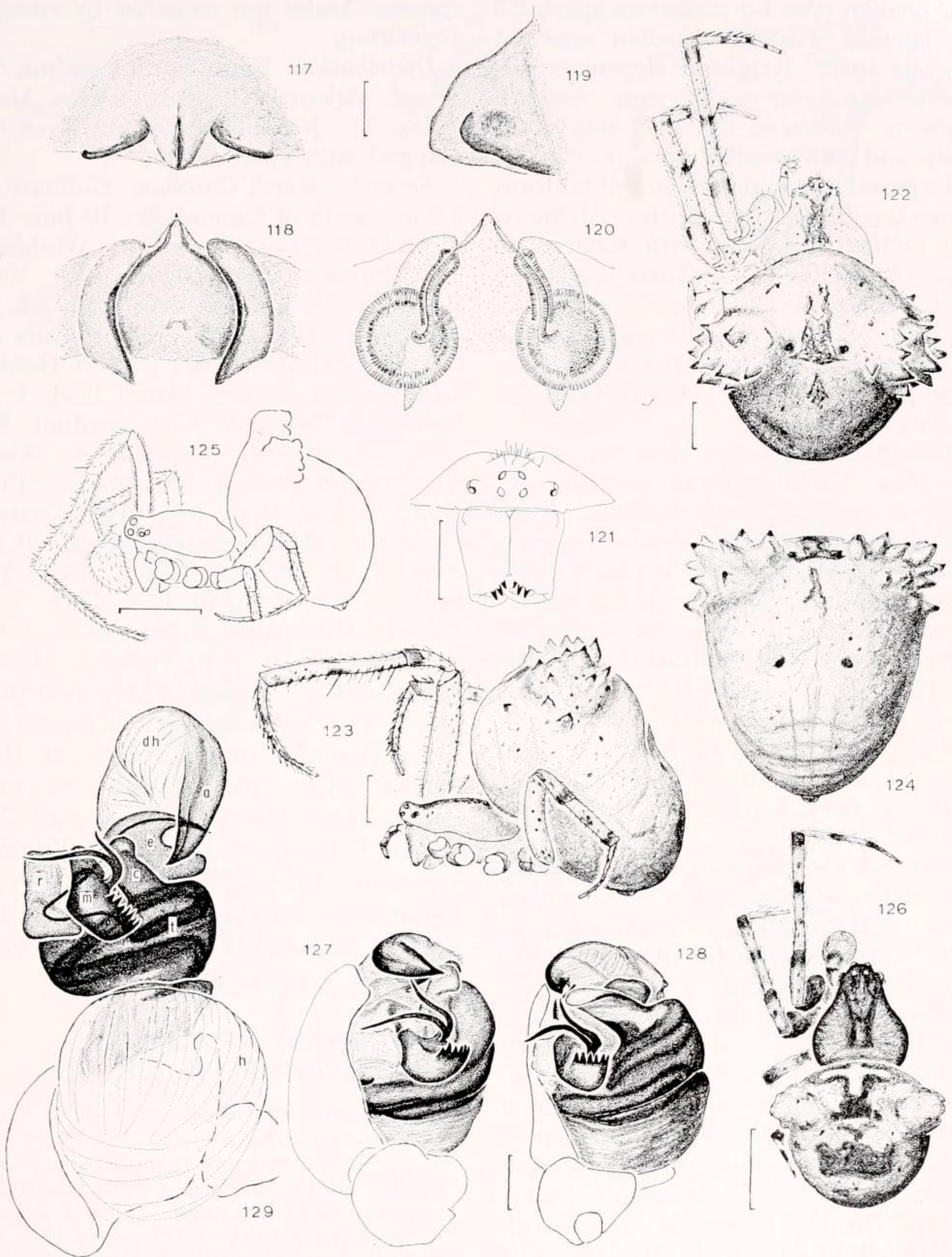
*Epeira alba* Hentz, 1850, J. Boston Soc. Natur. Hist., 6: 20, pl. 3, fig. 7. Female from North Carolina in the Boston Natural History Society, destroyed.

*Kaira alba*:—Keyserling, 1892, Spinnen Amerikas,

4: 64, pl. 3, fig. 50, ♀. McCook, 1893, American Spiders, 3: 202, pl. 13, fig. 3, ♀. Comstock, 1912, Spider Book, p. 450, fig. 461, ♀; 1940, Spider Book, rev. ed., p. 464, fig. 461, ♀. Roewer, 1942, Katalog der Araneae, 1: 904.

*Caira alba*:—Bonnet, 1956, Bibliographia Araneorum, 2: 924.

*Description.* Female from Florida. Carapace yellow-white with a median darker line of black spots and some straggly white setae (Fig. 122). Sternum with tiny black spots. Legs yellowish white with tiny black spots and narrow broken black bands on venter (Fig. 123). Dorsum of abdomen with a black mark between humps, sides with tiny black spots (Figs. 122, 124, 126). Venter spotted black. Posterior median eyes subequal to anterior medians; laterals 0.8 diameter of anterior median eyes. An-



Figures 117-129. *Kaira alba* (Hentz). 117-124. Female: 117-120. Epigynum: 117. Ventral. 118. Posterior. 119. Lateral. 120. Posterior, cleared. 121. Eye region and chelicerae. 122. Female, dorsal. 123. Female, lateral. 124. Abdomen, posterior. 125-129. Male: 125. Lateral. 126. Dorsal. 127-129. Left palpus: 127. Mesal. 128. Ventral. 129. Expanded. subventral.

**Abbreviations.** a, terminal apophysis; c, conductor; dh, distal hematodocha; e, embolus; h, hematodocha; m, median apophysis; r, radix; t, tegulum.

**Scale lines.** 0.1 mm except Figs. 122-126, 1.0 mm.

terior median eyes 1.5 diameters apart, 2.5 from laterals. Posterior median eyes 1.4 diameters apart. Height of clypeus equals diameter of anterior median eyes. Anterior margin of chelicerae has two long teeth distally and two smaller ones proximally. On the posterior margin are two distal teeth and two small proximal denticles. Abdomen much higher than long with tuberculate humps (Figs. 123, 124). Total length 6.5 mm. Carapace 2.9 mm long, 2.7 mm wide. First femur, 3.6 mm; patella and tibia, 4.4 mm; metatarsus, 2.3 mm; tarsus, 1.1 mm. Second patella and tibia, 3.6 mm; third, 2.2 mm; fourth, 2.8 mm.

Male coloration darker than that of female (Fig. 126). Anterior median eyes slightly more than their diameter apart, slightly less than one from laterals. Posterior median eyes slightly more than their diameter apart, 1.5 from laterals. Abdomen vertical with large humps that are slightly irregular, only faintly indicating tubercles (Fig. 126). Total length 3.0 mm. Carapace 1.4 mm long, 1.1 mm wide. First femur, 1.7 mm; patella and tibia, 2.1 mm; metatarsus, 1.1 mm; tarsus, 0.7 mm. Second patella and tibia, 1.6 mm; third, 0.9 mm; fourth, 1.2 mm.

*Variation.* The shape of the two humps of the abdomen is variable. Females vary in total length from 6.5 to 7.3 mm, carapace 2.9 to 3.1 mm long; males from 2.6 to 3.0 mm in total length.

*Diagnosis.* The median longitudinal keel of the lightly sclerotized epigynum (Figs. 117, 119) separates the species from *K. altiventer*. The shape of the conductor of the palpus (Figs. 128, 129) and the pointed terminal apophysis (Figs. 127, 129) separates the species from *K. hiteae*.

*Natural History.* Females have been collected in all seasons, males only in early summer. In Florida females have been collected on grass stems; in mangrove hammocks, and in shrubs bordering a red and white mangrove hammock; a male from Arkansas came from oak-hickory brush. We do not know the web of this uncommon

species. Males are collected by sweeping vegetation.

*Distribution.* From North Carolina, Tennessee, Arkansas to northeastern Mexico (Map 3). Juvenile specimens have been mapped with open circles.

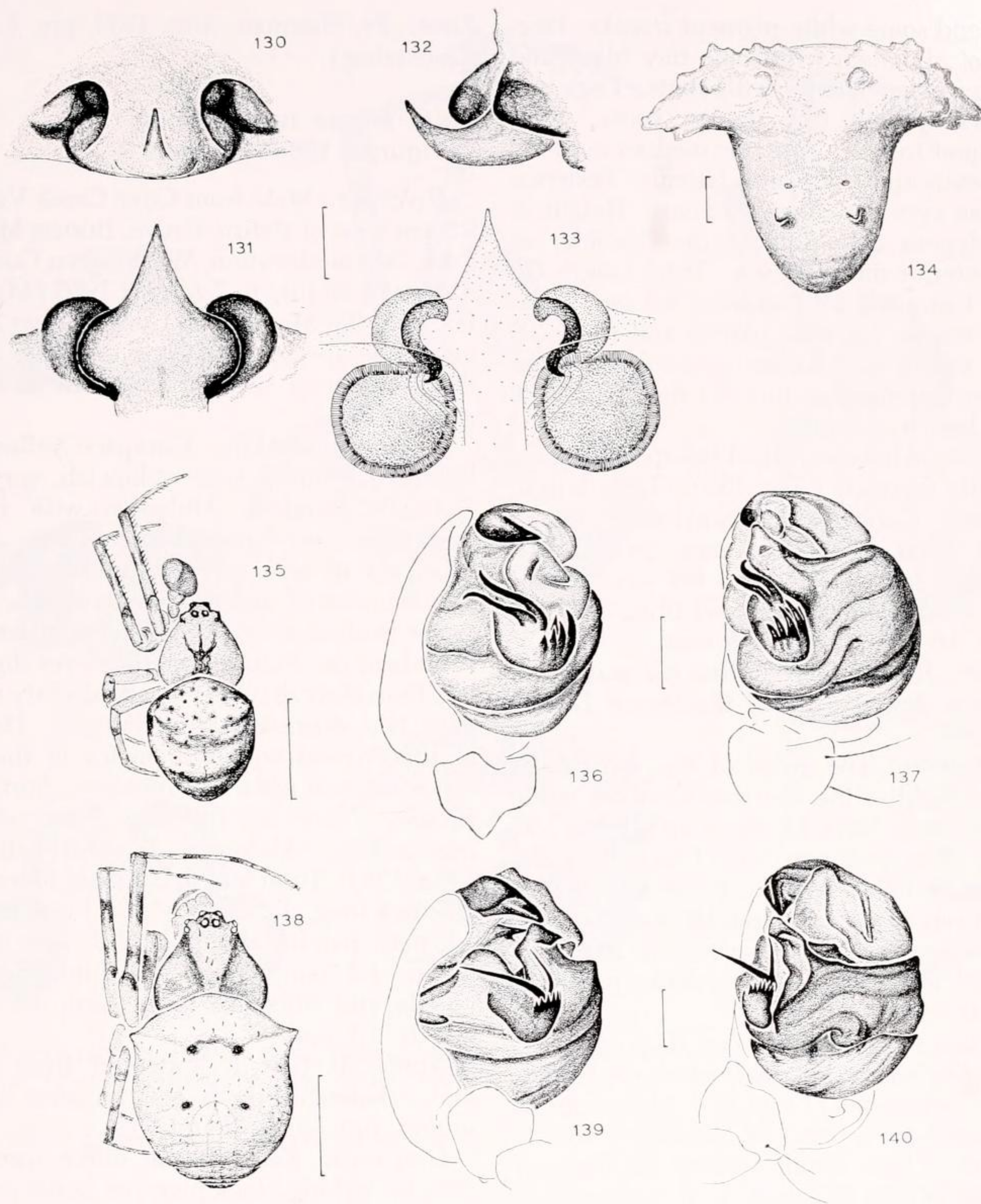
*Records. North Carolina.* Guilford Co.: 5.2 mi. north of Greensboro, 10 June 1953, ♂ (R.D. Barnes). *Tennessee.* Washington Co.: Johnson City, 12 June 1951, ♀ (O. Bryant). *Florida.* Jackson Co.: 12 May 1935, juv. (H.K. Wallace). Alachua Co.: Gainesville, 10 Oct. 1963, ♀ (L.A. Hetrick). Lake Co.: Leesburg, March 1954, ♀ (M. Statham). Seminole Co.: Sanford, Sept. 1927, juv. (Stone). Osceola Co.: Kissimmee, juv. (N. Banks). Sarasota Co.: Englewood, 1 Apr. 1938, juv. (W.J. Gertsch). Dade Co.: Matheson Hammock, 20 June 1964, ♀ (K. Stone). Monroe Co.: 2 mi. north of Flamingo, 21 June 1964, ♀ (K. Stone). *Mississippi.* Wilkinson Co.: Centreville, 1944, ♂ (A.F. Archer). *Missouri.* Stoddard Co.: Ardeola, 22 July 1950, ♀ (H. Exline). *Arkansas.* Washington Co.: 15 mi. west of Prairie Grove, ♂ (M. Hite). Randolph Co.: 16 June 1963, ♂ (Exline Coll.). *Texas.* Denton Co.?: Decator, 1945, ♂ (H. Exline). Hidalgo Co.: Edinburg, Sept.-Dec. 1933, ♀ (S. Mulaik). *Mexico.* Tamaulipas. Soto La Marina, 16 May 1952, ♀ (W.J. Gertsch). San Luis Potosí. Valles, July 1959, juv. (L. Steude).

### *Kaira altiventer* O.P.-Cambridge Figures 130-137; Map 3

*Kaira altiventer* O.P.-Cambridge, 1889, *Biologia Centrali-Americana, Araneidea*, 1: 56, pl. 3, fig. 13, ♀. Female holotype from Veragua, Panama, in the British Museum, Natural History, examined. Keyserling, 1892, *Spinnen Amerikas*, 4: 62, pl. 3, fig. 48, ♀. F.O.P.-Cambridge, 1904, *Biologia Centrali-Americana, Araneidea*, 2: 522, pl. 51, fig. 10, ♀. NEW SYNONYMY.

? *Kaira obtusa* Keyserling, 1892, *Spinnen Amerikas*, 4: 66, pl. 3, fig. 51, juvenile holotype from Taguara, Rio Grande do Sul, examined.

*Caira spinosa* Simon, 1896, *Ann. Soc. Entomol. France*, 65: 478. Female lectotype here designated and juvenile paralectotype from São Paulo de Olivença, Amazonica, Brazil and Pebas, Peru



Figures 130-137. *Kaira altiventer* O.P.-Cambridge. 130-134. Female: 130-133. Epigynum: 130. Ventral. 131. Posterior. 132. Lateral. 133. Posterior, cleared. 134. Abdomen, posterior. 135-137. Male: 135. Dorsal. 136, 137. Left palpus: 136. Mesal. 137. Ventral.

Figures 138-140. *K. hiteae*, male. 138. Dorsal. 139, 140. Palpus: 139. 140. Palpus: 139. Mesal. 140. Ventral. Scale lines. 0.1 mm except Figs. 134, 135, 138, 1.0 mm.

in the Muséum National d'Histoire Naturelle, Paris, examined. NEW SYNONYMY.

*Pronarachne aries* Mello-Leitão, 1937, An. Acad. Brasileira Sci., 9: 9, fig. 10, ♀. Female holotype from Itatiaia, Rio Grande do Sul in the

Museu Nacional, Rio de Janeiro, examined. NEW SYNONYMY.

*Description.* Female from Texas. Carapace yellow-white with some tiny orange

dots and some white pigment streaks. Dorsum of abdomen with some tiny black and orange spots. Venter with spots. Legs yellow-white with tiny orange spots. Eyes subequal in size. Anterior median eyes 1.2 diameters apart, 2.5 from laterals. Posterior median eyes one diameter apart. Height of the clypeus equals about the diameter of the anterior median eyes. Total length 6.0 mm. Carapace 2.9 mm long, 2.3 mm wide. First femur, 3.0 mm; patella and tibia, 3.9 mm; metatarsus, 2.0 mm; tarsus, 0.9 mm. Second patella and tibia, 3.1 mm; third, 1.6 mm; fourth, 2.3 mm.

Male. Abdomen shield-shaped, humps dorsally directed (Fig. 135). Total length 2.0 mm. Carapace 1.2 mm long, 1.0 mm wide. First femur, 1.1 mm; patella and tibia, 1.3 mm; metatarsus, 0.8 mm; tarsus, 0.4 mm. Second patella and tibia, 1.0 mm; third, 0.6 mm; fourth, 0.8 mm.

*Note.* It is not certain that the males and females described and illustrated belong together.

*Variation.* The palpi of the two males differ slightly; the illustrations were made of the male from El Salvador (Figs. 136, 137). The specimen from Costa Rica differs in that the two flagella of the median apophysis are more straight and the conductor seems slightly turned on its longitudinal axis facing the median apophysis, appearing less pointed.

*Diagnosis.* Females can be separated from *Kaira alba* by the hook-shaped scape of the epigynum (Fig. 132). Males can be separated from those of *K. alba* by the direction of the distal swelling of the conductor (Fig. 137), and by the absence of a lateral fold (Fig. 137) from *K. hiteae*.

*Distribution.* Texas to South America (Map 3).

*Records.* Texas. Hidalgo Co.: Edinburg, 6 Dec. 1935, ♀ (S. Mulaik). El Salvador. San Salvador, Jan.–March, 1954, ♂ (J.B. Boursot). Costa Rica. Guanacaste Prov.: 4 km NW Cañas La Pacifica, 7 Feb.–2 March 1975, ♂ (R. Coville from *Trypargilum nitidum* muddauber nest). Canal

Zone. Ft. Sherman, Aug. 1939, juv. (A.M. Chickering).

### *Kaira hiteae* new species

Figures 138–140; Map 3

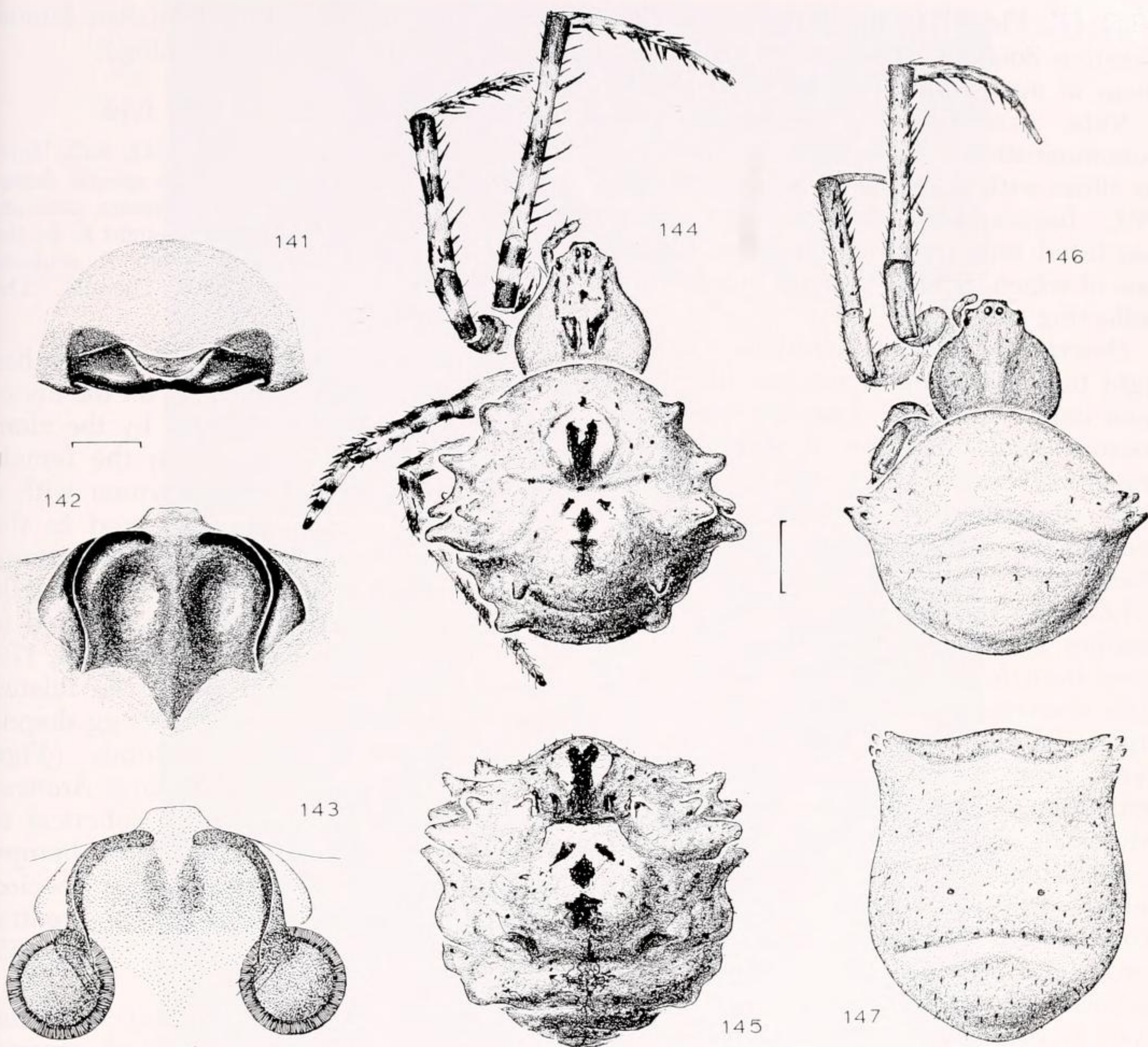
*Holotype.* Male from Cove Creek Valley, 9.3 km west of Prairie Grove, Boston Mountains, 300 m elevation, Washington County, Arkansas, 26 July to 7 August 1956 (Maxine Hite) in the Museum of Comparative Zoology. The species is named after M. Hite, the collector of several specimens of these rare species.

*Description.* Male. Carapace yellowish, lighter in center. Legs yellowish, very indistinctly banded. Abdomen with indistinct transverse bands, venter white. Eyes subequal in size, except anterior laterals 0.8 diameter of anterior median eyes. Anterior median eyes 1.3 diameter apart, 1.3 from laterals. Posterior median eyes slightly less than their diameter apart, slightly more than two diameters from laterals. Height of the clypeus equals diameter of the anterior median eyes. Endites are short and square. None of the legs have strong macrosetae. Abdomen is shield-shaped (Fig. 138). Total length 2.6 mm. Carapace 1.3 mm long, 1.2 mm wide. First femur, 1.5 mm; patella and tibia, 1.9 mm; metatarsus, 1.2 mm; tarsus, 0.7 mm. Second patella and tibia, 1.4 mm; third, 0.8 mm; fourth, 1.1 mm.

*Note.* At first it appeared that these males belonged with the females of *K. sabino*, but I now doubt this.

*Diagnosis.* *Kaira hiteae* differ from *K. alba* by lacking black pigment in the center of the carapace and between the humps (Fig. 138); in *K. hiteae* this area is lightest. They differ too by having transverse bands on the abdomen and on the single point of the humps (Fig. 138). The males have a more blunt terminal apophysis (Fig. 139), the conductor has an edge laterally (Fig. 140) and a slightly more distal attachment of the flagellae to the median apophysis (Figs. 139, 140).

*Natural History.* One male from Dallas



Figures 141-147. *Kaira sabino* n. sp., female. 141-143. Epigynum: 141. Ventral. 142. Posterior. 143. Posterior, cleared. 144-147. Female: 144, 146. Dorsal. 145, 147. Abdomen, posterior. 144, 145. Paratype (Portal, Arizona). 146, 147. Holotype (Sabino, Arizona).

Scale lines. 0.1 mm except Figs. 141-144, 1.0 mm.

County, Texas had a label stating it had been collected with spiders from "road, woods, herbs and shrubs."

*Distribution.* South Carolina, Arkansas, Texas (Map 3).

*Records.* South Carolina. York Co.: 3.4 mi. west of Sharon, 4 Aug. 1953, juv. ♂ (R. Barnes). Arkansas. Washington County: Cove Creek Valley, Boston Mts., 1000 ft., 26 July, 7 Aug. 1956, 2 ♂ (M. Hite), one deposited in Canadian National Collection.

Texas. Dallas Co.: Coit, 2 Aug. 1940, ♂ (S. Jones). Grayson Co.: Sherman, 25 July 1963, 2 ♂ (K.W. Haller). (All but first listed specimen have been marked as paratypes.)

*Kaira sabino* new species  
Figures 141-147; Map 3

*Holotype.* Female from Sabino [? Canyon, Pima County], Arizona, 2 September



1932 (R. Flock) in the Museum of Comparative Zoology. The specific name is a noun in apposition after the type locality.

*Note.* According to J. Beatty (personal communication), there may be numerous localities with the name of Sabino, Arizona. W.C. Barnes, 1960, *Arizona Place Names* has listed only two, both in Pima County, one of which, Sabino Canyon, is a common collecting site.

*Description.* Female holotype. Carapace light brown, darker brown on sides. Sternum darker on sides. Legs with indistinct narrow bands. Dorsum of abdomen with transverse bands (Figs. 145, 147). Sides light, venter with white pigment. Posterior median eyes 1.5 diameters of anterior medians, anterior laterals 1.2; posterior laterals 1.5 diameters of anterior medians. Anterior median eyes 2 diameters apart, 2.5 diameters from laterals. Posterior median eyes their diameter apart. Height of the clypeus equals 1.5 diameters of the anterior median eyes. First metatarsus curved and armed with strong and weak setae (Figs. 144, 146). Abdomen appears shield-shaped, having small tubercles on the humps (the abdomen, however, is in very poor condition). Total length 5.8 mm. Carapace 2.4 mm long, 1.9 mm wide. First femur, 3.2 mm; patella and tibia, 4.0 mm; metatarsus, 2.3 mm; tarsus, 1.0 mm. Second patella and tibia, 3.1 mm; third, 1.7 mm; fourth, 2.2 mm.

*Note.* It appeared at first that these females belonged with the males of *K. hiteae*, but I now doubt this.

*Variation.* The second specimen, although having a similar epigynum to the first and doubtlessly of the same species, is quite different in appearance: it has scattered black pigment and many more abdominal tubercles (Figs. 144, 145). Since a fluffy egg-sac is in the vial, it must have oviposited and the abdomen shriveled.

*Diagnosis.* The wide short scape of the epigynum, which appears to be a transverse lip (Fig. 141), is very distinct from the narrow keel or hook of the two other species.

*Paratype.* Arizona. Cochise Co.: 1 mi.

east, 7 mi. north of Portal on San Simon Road, 17 July 1973, ♀ (A. Jung).

### *Aculepeira* Chamberlin and Ivie

*Aculepeira* Chamberlin and Ivie, 1942, Bull. Univ. Utah, biol. ser., 7(1): 75. Type species designated by original authors as *Epeira aculeata* Emerton, which these authors thought to be the name of *A. carbonarioides*; actually *E. aculeata* is a synonym of *A. packardi* (Thorell). The name *Aculepeira* is feminine.

*Diagnosis.* *Aculepeira*, like *Metepeira*, has a median, ventral white streak on the abdomen but differs in both sexes by the elongate, egg-shaped abdomen, in the female by the large, sclerotized epigynum with a large scape (Figs. 148, 162), and in the male by the large palpus with long, prominent, median apophysis with two flagella (Figs. 159, 161) and a large boat-shaped to disk-shaped conductor (Figs. 158, 160, 170, 172). *Aculepeira* differs from the related *Araneus* by having an elongate, egg-shaped abdomen that is widest anteriorly (Figs. 154, 166); the abdomen of the large *Araneus* usually ranges in shape from spherical to longer than wide and may have humps. Unlike any of the large *Araneus* species, *Aculepeira* species have a median, ventral white mark on the abdomen (Figs. 155, 168).

*Description.* Carapace with eye area and thoracic rim light and thorax dark covered by white down; sternum, brownish black. Legs banded; abdomen with a dorsal longitudinal lobed band (Figs. 154, 166) and a ventral white mark on black (Figs. 155, 168). Eyes subequal in size, laterals sometimes smaller. Anterior median eyes slightly more than their diameter apart, posterior median eyes their diameter apart; in female, slightly closer spaced than in male. Height of the clypeus, about 1.5 to almost 2 diameters of the anterior median eyes (Fig. 174). The thorax with a shallow depression (Figs. 154, 166, 174). Abdomen, chicken-egg-shaped, longer than wide, widest anteriorly (Figs. 154, 166) and covered with setae; very hairy in *A. carbonaria* and *A. carbonarioides*.



Plate 6. *Aculepeira packardi*. Above, spider in web; below, spider in a disc-shaped retreat in vegetation.

Male smaller than female (Fig. 157), chelicerae small and anteriorly concave. Endites with a tooth laterally facing another tooth at the proximal end of palpal femur. First coxae with a hook fitting into a groove of second femur. The second coxae with a median ventral pointed hump in most species and the fourth trochanter with a posterior macroseta in most species (Fig. 175). Second tibia distally wider with

short macrosetae, one of which is on a projecting hump (Figs. 156, 159).

Genitalia similar to those of *Araneus*, especially to *A. washingtoni* Levi. Epigynum, an annulate scape on a base (Figs. 148-152, 162-163) and lamellae on each side posterodorsally (Figs. 150, 164). Palpal patella with two macrosetae (Fig. 172); palpal parts like those of *A. washingtoni*, except for a long median apophysis with

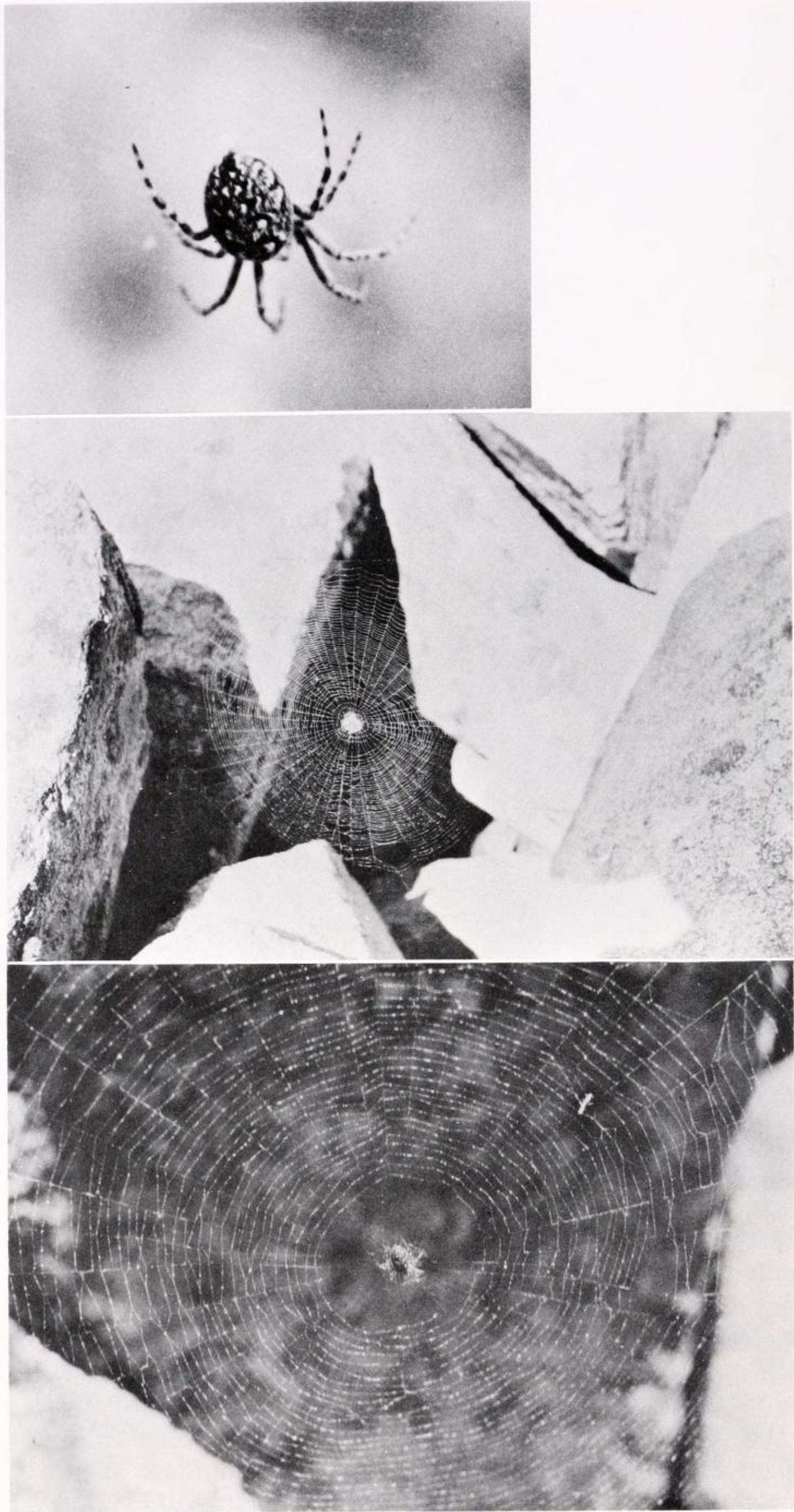


Plate 7. *Aculepeira carbonarioides*. Top, female; middle and bottom, orb-web in talus in Colorado. Webs dusted with cornstarch. Viscid area of web approximately 15–20 cm diameter.

two proximal flagella (m in Figs. 161, 173). Conductor a deep sclerotized boat-shaped to disk-shaped structure (Figs. 158, 160, 170, 172); embolus (e in Figs. 161, 173) hidden in contracted palpus by the terminal apophysis (a in Figs. 161, 173) and lacking a cap in virgin males. Terminal apophysis a long sclerotized prong with a hook at its base (a in Figs. 161, 173). Subterminal apophysis acutely pointed in *A. packardi*, more blunt in *A. carbonarioides* but hidden underneath the terminal apophysis (Figs. 158, 170 and sa in Figs. 161, 173).

*Eurasian Species.* The three common European species, frequently confused with the North American ones, have been illustrated (Figs. 187–217). I had first planned to revise *Aculepeira* worldwide, but lack of specimens, especially males from the Near East, made this impossible. There were nomenclatural and biological problems that I could not resolve (see Methods above).

Thorell (1870) gave the name *Epeira victoria* to illustrations by C. L. Koch of a spider from Germany and France on low plants in meadows and the border of forests (C. L. Koch, 1834, 1839). Drensky (1943) thought *A. victoria* to be the same as *A. armida*, although the latter species is not known to occur in Germany.

The specimens from Switzerland labeled *A. victoria* in the British Museum and the Naturhistorisches Museum, Basel are probably *A. armida*. But there are female specimens from Dalmatia and Samarkand, USSR, in the Natural History Museum, Stockholm that may be distinct (Figs. 226–231). These have a shorter scape and wide lamellae posterodorsal to the epigynum.

*Epeira armida* was described from southern France and northern Israel. Are the populations found in these two areas the same species? I examined several collections from Turkey and all but two were females. None looked quite alike. Karol (1964, 1966) recently described two species (*A. vachoni*, *A. karapagi*) from females

from Turkey without making comparative reference to the other species reported from the area.

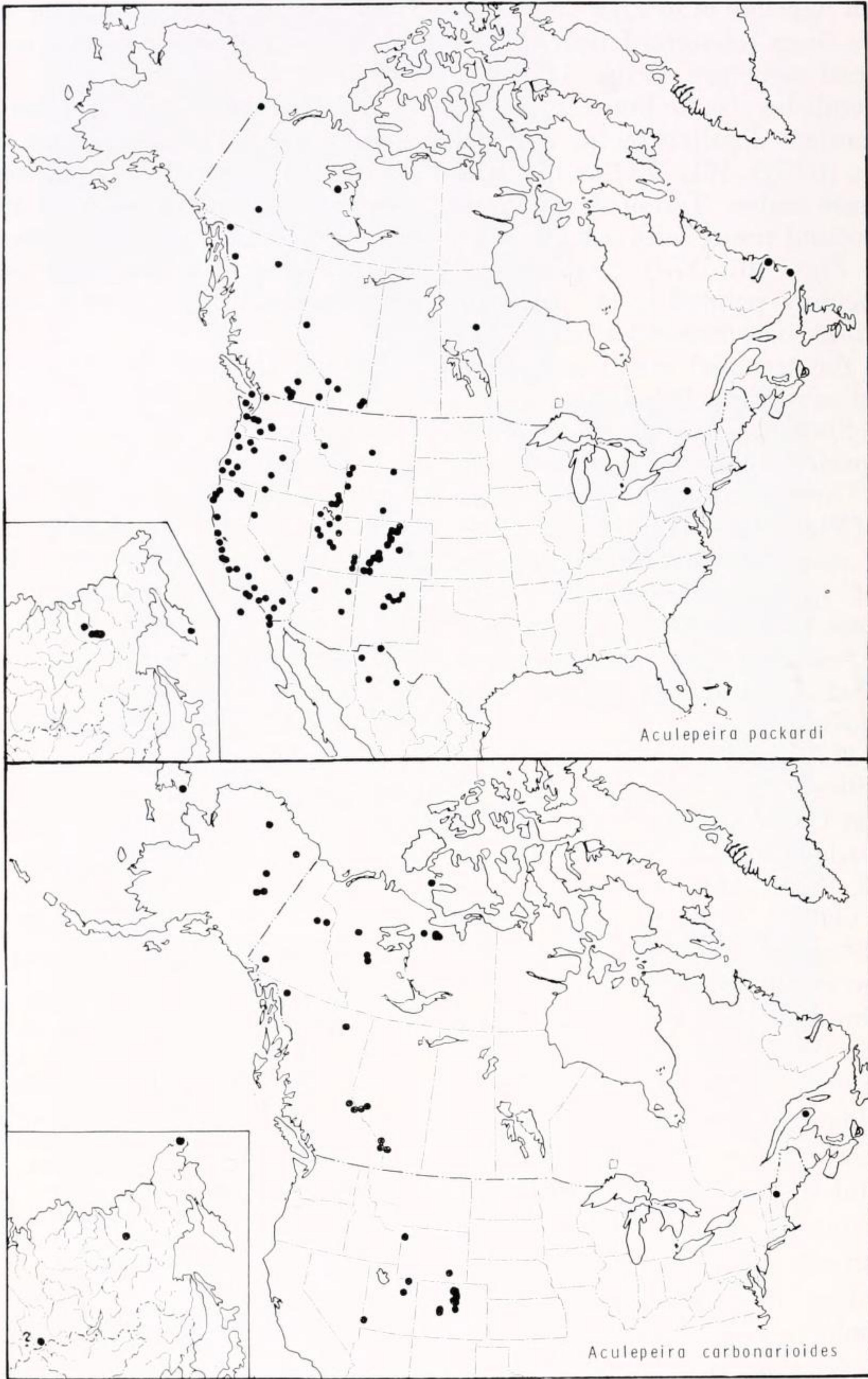
The type of *A. vachoni* was examined and it appeared to be a female *A. ceropegia* having the scape of the epigynum torn off. *Aculepeira karapagi* appears to be a distinct species previously described as *Epeira similis* Nosek, 1905 (a name preoccupied) and subsequently renamed *E. noseki* Strand, 1907.

*Natural History.* Both American species make fairly large orbs and one is found in extreme habitats not otherwise frequented by large orb-weavers. *Aculepeira packardi* has a retreat (Plate 6), *A. carbonarioides* does not (Plate 7). *Aculepeira packardi* males are more commonly collected than females, usually by sweeping, but *A. carbonarioides* males are rare in collections, presumably because it is difficult to collect among boulders.

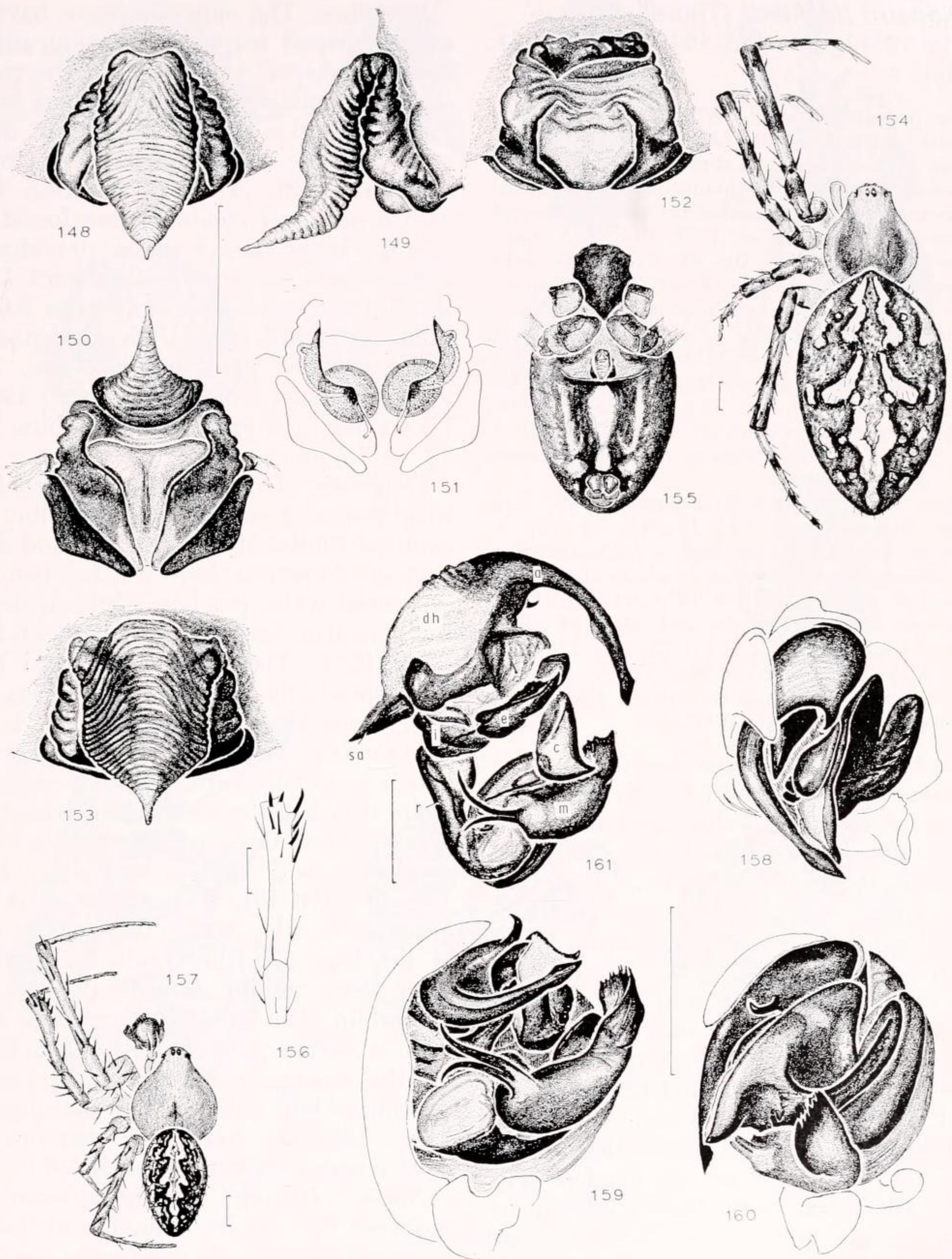
*Note on Names.* Both Keyserling and Emerton realized there are two species in North America, but each called a different one *Epeira carbonaria* and gave the second a new name. Neither American species is *A. carbonaria*.

#### KEY TO AMERICAN ACULEPEIRA SPECIES

1. Dorsum of abdomen in both sexes with median, paired, upside-down, comma-shaped marks or posteriorly directed lobes (Figs. 154, 157); width of scape of epigynum more than half the width of base (Fig. 148) or scape torn off (Fig. 152); epigynum in posterior view with median area framed by convexly lobed lateral pieces (Figs. 150, 151); conductor of palpus relatively wide with ventral lip (Figs. 160, 176–181) ..... *packardi*
- Dorsum of abdomen with paired white pigment patches, but no lateral, posteriorly directed lobes (Fig. 166), or with indistinct dark pattern of paired spots (Fig. 167); width of scape of epigynum less than a third the width of base (Figs. 162, 182, 185); scape rarely torn off; epigynum in posterior view with median area framed by concavely curved lateral pieces (Figs. 164, 165, 183, 186); conductor of palpus narrow without a lip around ventral margin (Figs. 170, 172) ..... *carbonarioides*



Map. 4. Distribution of North American *Aculepeira* species.



Figures 148-161. *Aculepeira packardi* (Thorell). 148-153. Epigynum: 148, 152, 153. Ventral. 149. Lateral. 150. Posterior. 151. Posterior, cleared. 152. Scape torn off. 148-151. (California). 152. (Nevada). 153. (Colorado). 154. Female, dorsal. 155. Female abdomen and sternum, ventral. 156. Left male second patella and tibia, dorsal. 157. Male, dorsal. 158-161. Left male palpus: 158. Apical. 159. Mesal. 160. Ventral. 161. Expanded, mesal view.

**Abbreviations.** a, terminal apophysis; c, conductor; dh, distal hematodocha; e, embolus; i, stipes; m, median apophysis; r, radix; sa, subterminal apophysis.

**Scale lines.** 1.0 mm.

*Aculepeira packardii* (Thorell)

Plate 6; Figures 148–161, 174, 176–181;  
Map 4

*Epeira packardii* Thorell, 1875, Proc. Boston Soc. Natur. Hist., 17: 490. Left palpus of holotype from Square Island, Labrador in the Natural History Museum, Stockholm, examined; the remaining parts of specimen probably destroyed.

*Epeira aculeata* Emerton, 1877, Bull. U.S. Geol. Surv. Territ., 3: 528, fig. 18, ♀. Female holotype from Gray's Peak [Front Range, Summit Co.], Colorado, lost. Emerton, 1894, Trans. Connecticut Acad. Sci., 9: 405, pl. 1, fig. 4 a, c, e, ♀, ♂. NEW SYNONYMY.

*Epeira carbonaria*:—Keyserling, 1892, Spinnen Amerikas, 4: 204, fig. 151, ♀, ♂. McCook, 1894, American Spiders, 3: 157, pl. 5, figs. 1, 2, ♀, ♂. Misidentification, not *A. carbonaria* (L. Koch).

*Araneus septentrionalis* Kulczynski, 1908, Zap. Imp. Akad. Nauk, (8) 18: 47, fig. 57, ♀. Female holotype from Sataghai, Adytscha River, in central Siberia, in Polish Academy of Sciences, Warsaw, examined. NEW SYNONYMY.

*Aculepeira verae* Chamberlin and Ivie, 1942, Bull. Univ. Utah, biol. ser., 7(1): 75, figs. 215, 216, ♂. Male holotype from Bear Valley, Idaho in the American Museum of Natural History, examined. NEW SYNONYMY.

*Note.* This species has been called *carbonarius* by Gertsch and Ivie in collections and *verae* by Chamberlin and Ivie.

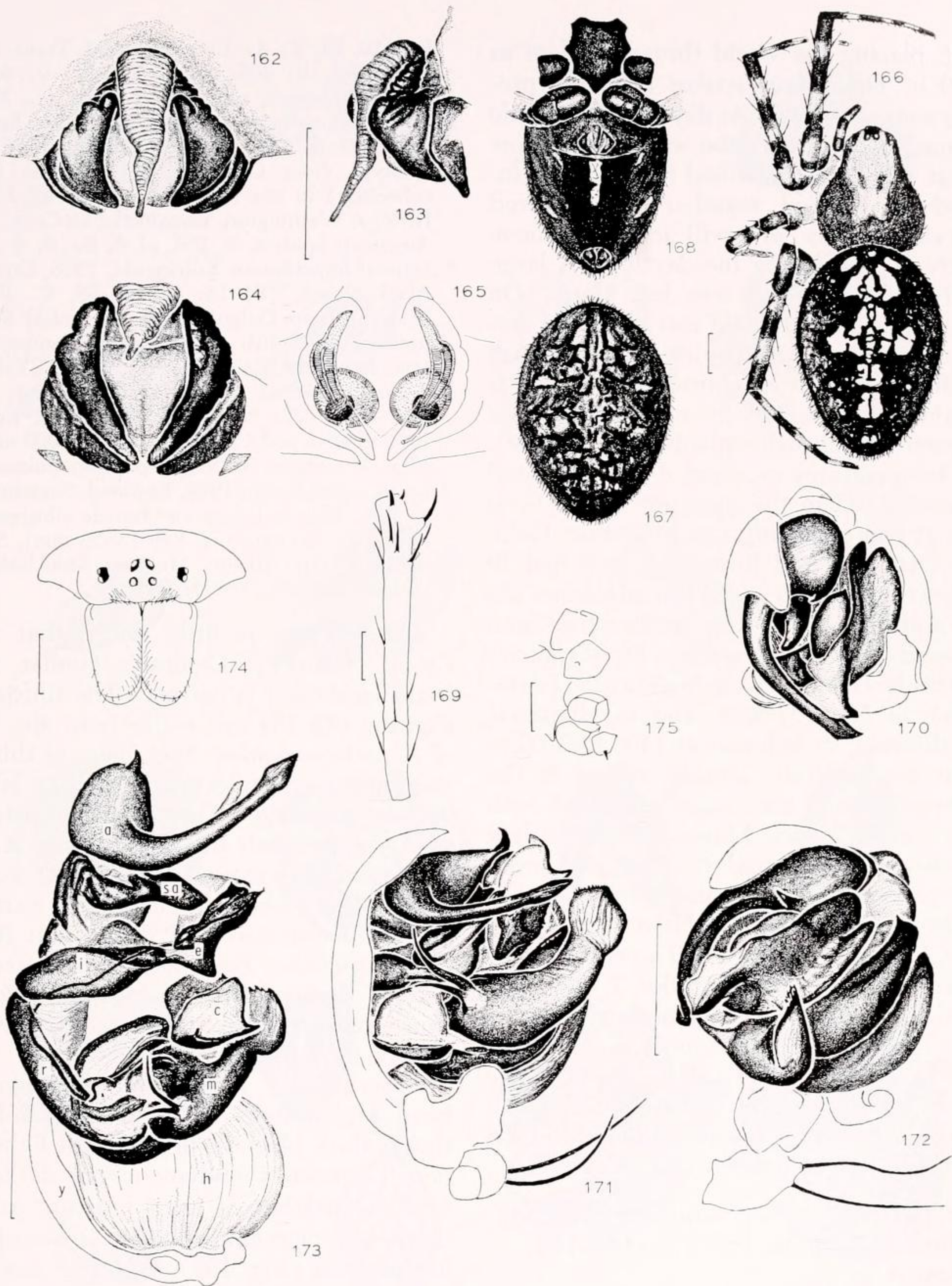
*Description.* Female from California: carapace brown, head region lighter and covered with white down. Sides of thorax lighter. Dorsum of abdomen with characteristic pattern (Fig. 154). Total length 11.5 mm. Carapace 4.7 mm long, 3.7 mm wide. First femur, 4.7 mm; patella and tibia, 5.8 mm; metatarsus, 4.1 mm; tarsus, 1.4 mm. Second patella and tibia, 5.2 mm; third, 3.1 mm; fourth, 5.0 mm.

Male from California: coloration like female, but legs less distinctly banded (Fig. 157). Chelicerae with three teeth on anterior margin and a small denticle most distant from base of fang, posterior margin with three teeth. Total length 9.4 mm. Carapace 4.4 mm long, 3.6 mm wide. First femur, 5.5 mm; patella and tibia, 6.8 mm; metatarsus, 4.6 mm; tarsus, 1.4 mm. Second patella and tibia, 5.3 mm; third, 3.2 mm; fourth, 5.1 mm.

*Variation.* The only specimens having a similar shaped scape on the epigynum or similarly shaped conductor on the palpus are those collected together. There is surprising variation in these structures. Specimens with the widest palpal conductor are sympatric with *A. carbonarioides*; those with a narrower conductor are found outside the latter species range, providing an example of character displacement (Figs. 176–181). Total length of females, 5.6 mm (Yukon) to 16.5 mm (Utah), carapace 2.7 to 6.3 mm long, 2.0 to 5.2 mm wide. Total length of males 5.0 (Labrador) to 8.9 mm (Wyoming), carapace 2.6 to 4.4 mm long, 2.1 to 3.7 mm wide.

*Diagnosis.* This species can be confused with *Neoscona oaxacensis* (Keyserling) because of similar abdomen shape and dorsal pattern. *Neoscona*, however, has two pairs of ventral white patches, while *Aculepeira* has a median, ventral white streak on black (Fig. 155). The dorsal abdominal band, with posteriorly directed lobes (Figs. 154, 157), separates specimens from *A. carbonarioides*. The scape of the epigynum, which is usually torn off after mating, is wider than half the width of the base (Figs. 148, 152) and the conductor is about twice as long as wide with a ventral lip (Figs. 158, 160, 176–181). The scape of *A. carbonarioides* is less than a third of the width of the base and the conductor is almost three times as long as wide and lacks the ventral lip. The species is close to the European *A. ceropegia*; but *A. ceropegia* differs by the triangular scape, by the median sclerotized lobe of the base of the epigynum (Figs. 188–192) and by the enormous, almost circular, conductor (Fig. 197).

*Natural History.* I have collected and observed this species a number of times in western Colorado where its webs are found among the vegetation of lush meadows at 2500 to 3000 m elevation. It is never abundant. Even an entire summer of collecting may yield only a few specimens. The females are mature in August in Colorado. The adult females make a new web every



Figures 162-173. *Aculepeira carbonarioides* (Keyserling). 162-165. Epigynum: 162. Ventral. 163. Lateral. 164. Posterior. 165. Posterior, cleared. 166-168. Female: 166. Dorsal. 167. Abdomen, dorsal. 168. Abdomen and sternum, ventral. 169-173. Male: 169. Left second patella and tibia, dorsal. 170-173. Left palpus: 170. Apical. 171. Mesal. 172. Ventral. 173. Submesal, expanded.

Figure 174. *A. packardi* (Thorell). Female eye region and chelicerae.

Figure 175. *A. ceropegia* (Walckenaer). Left coxae of male, ventral.

Abbreviations. a, terminal apophysis; c, conductor; e, embolus; h, hematodocha; i, stipes; m, median apophysis; r, radix; sa, subterminal apophysis; y, cymbium.

Scale lines. 0.1 mm.



night, placing the viscid threads as late as 23:00 h. Once, four spokes from the previous web were kept. At daytime the female is found at the side of the web in a shallow retreat (Plate 6) fashioned from several inclined leaves tied together and covered with silk threads. She will actively remove insects caught during the daytime. A large bumblebee, however, was left alone. On 12 August 1957 a female was observed eating a male of the species. Besides lush meadows in the mountains, the species is occasionally collected by sweeping grasses between sagebrush plants (*Artemisia*). The temperatures on clear days fluctuated between 2° C in the morning to 28° C at noon at one collecting site in Gothic, Colorado (near Crested Butte). A web had 19 radii, with about 25 viscid threads below the hub and 24 above. The species has been collected under white spruce (*Picea glauca*) in British Columbia, in sagebrush (*Artemisia*) in New Mexico, and in chaparral in California. It is found at 1400 to 2700 m elevations in Utah. During spring in the southern part of the range, adults of both sexes may be found. Males are as abundant in collections as females. They are probably collected by sweeping.

*Distribution.* Siberia, Alaska to Labrador and Chihuahua (Map 4). The easternmost record is Cartwright, Labrador, 7 July 1955, ♂ (E.E. Sterns, CNC). Another record is from Pennsylvania, Luzerne Co., Coyningham, ♂, 17 May 1923 (W.G. Dietz in the Academy of Natural Sciences, Philadelphia). The specimen was examined in 1968 but could not be located in 1977.

*Aculepeira carbonarioides* (Keyserling)  
Plate 7; Figures 162–173, 182–186;  
Map 4

*Epeira carbonaria*:—Emerton, 1884, Trans. Connecticut Acad. Sci., 315: pl. 33, fig. 18, pl. 36,

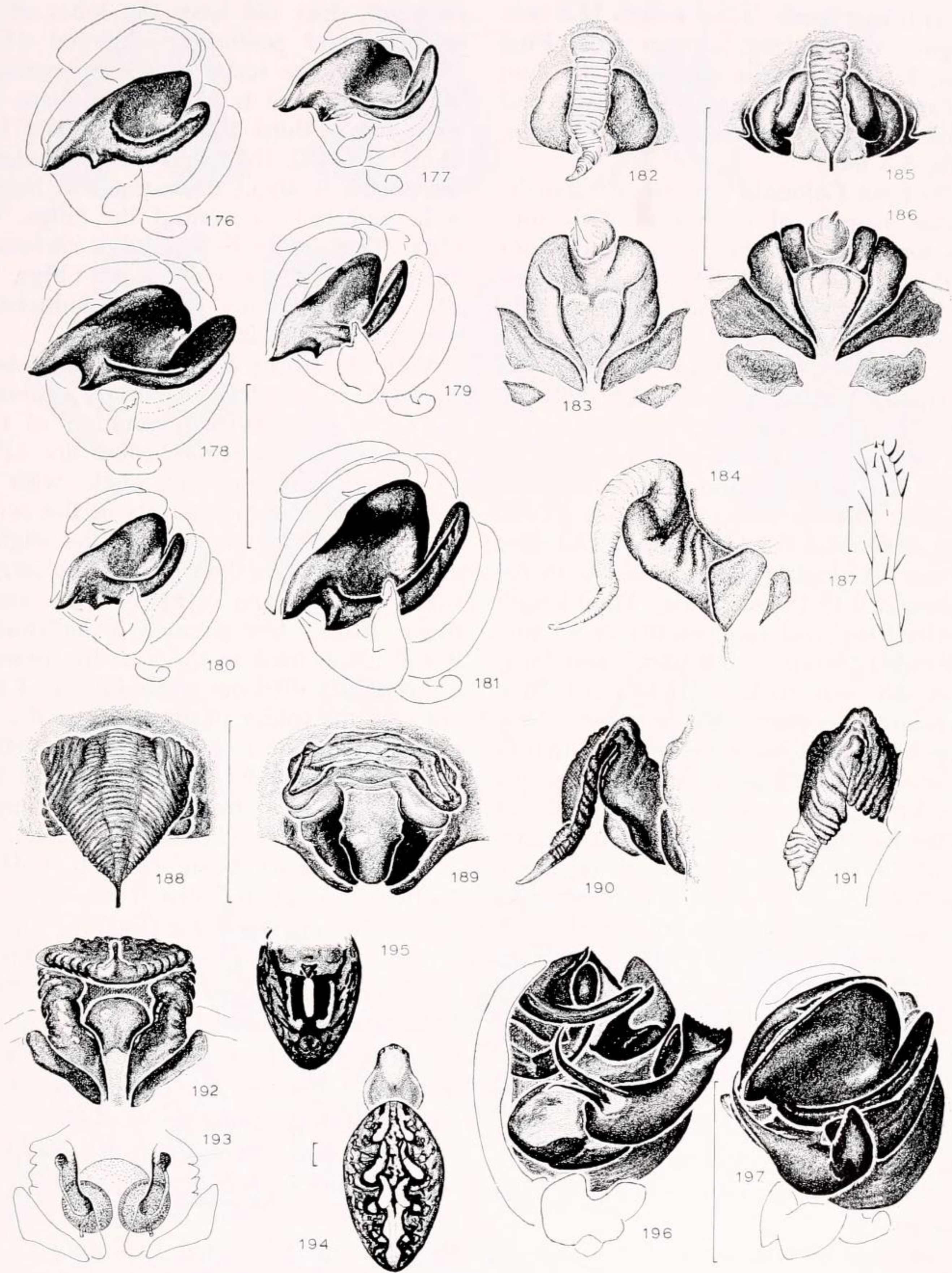
figs. 18, 19, ♀, ♂. Emerton, 1894, Trans. Conn. Acad. Sci., 9: 405, pl. 1, fig. 4b, ♀, 4d, ♂. Misidentification, not *A. carbonaria* (L. Koch).  
*Epeira carbonarioides* Keyserling, 1892, Spinnen Amerikas, 4: 206, pl. 10, fig. 152, ♀. Female holotype from Clear Creek, Colorado (Marx collection) in the National Museum of Natural History, Washington, examined. McCook, 1903, American Spiders, 3: 158, pl. 5, fig. 9, ♀, ♂.  
? *Araneus hyperboreus* Kulczynski, 1908, Zap. imp. Akad. Nauk, (8) 18: 45, fig. 58, ♀. Female holotype from Dolgulach River, central Siberia, probably in Polish Academy of Sciences, Warsaw, lost. PROBABLE NEW SYNONYMY.  
? *Aranea (Epeira) charitonovi* Ermolajew, 1928, Zool. Anz., 77: 209. Specimens from Karagai, 1000 m elev. and Chasinicha River, 3000 m elev., Altai Mountains, USSR, deposition unknown.  
*Araneus vegae* Holm, 1970, Entomol. Scandinavica, 1: 198. Male holotype and female allotype from Nun'amo, St. Lawrence Bay [Nunyamo], Siberia in the Natural History Museum, Stockholm, examined. NEW SYNONYMY.

*Note.* There is little doubt that Clear Creek [County], Colorado (unlike other Marx localities) is correct. The illustration Figures 182–184 are made from the types of *A. carbonarioides*. Specimens of this species from some collections had been labeled *Aranea aculeata*. Kulczynski's illustration of *A. hyperboreus* fits this species. *A. charitonovi* differs from *A. carbonaria*, according to the author, by having a narrower scape; in addition, the illustration fits *A. carbonarioides*. Ermolajew considered the species distinct from *A. hyperboreus* because of larger size; but the size varies widely in this species.

*Description.* Female from Colorado: head region light yellow-brown. Sides of thorax dark blackish brown with light border. Dorsum of abdomen very dark, covered by patches of light pigment and by tiny white pigment spots, also covered with lots of setae (Fig. 166). Anterior margin of chelicerae with four teeth, the second one from the fang base small; posterior margin

→  
Figures 176–181. *Aculepeira packardi* (Thorell), variation of conductor of left male palpus, ventral view. 176. (Kamchatka). 177. (Labrador). 178. (northern British Columbia). 179. (Mohave Desert, California). 180. (Washington). 181. (Arizona).

Figures 182–186. *A. carbonarioides* (Keyserling), variation of epigynum. 182, 185. Ventral. 183, 186. Posterior. 184. Lateral. 182–184. (Clear Creek, Colorado). 185–186. (Grand Teton Mountains, Wyoming).



Figures 187-197. *A. ceropegia* (Walckenaer) (France, Fig. 191 Switzerland). 187. Left male second patella and tibia, dorsal. 188-193. Epigynum: 188. Ventral. 189. Ventral, scape torn off. 190-191. Lateral. 192. Posterior. 193. Posterior, cleared. 194. Female, appendages removed. 195. Female abdomen, ventral. 196, 197. Left male palpus: 196. Mesal. 197. Ventral.

Scale lines. 1.0 mm.

also with four teeth. Total length 12.8 mm. Carapace 4.8 mm long, 3.9 mm wide. First femur, 5.3 mm; patella and tibia, 6.3 mm; metatarsus, 4.7 mm; tarsus, 1.6 mm. Second patella and tibia, 5.8 mm; third, 3.6 mm; fourth, 5.3 mm.

Male from Colorado colored like female. Anterior margin of chelicerae with four teeth, posterior with three on one side, four on other. Total length 8.6 mm. Carapace 4.9 mm long, 4.1 mm wide. First femur, 6.3 mm; patella and tibia, 8.4 mm; metatarsus, 6.1 mm; tarsus, 1.5 mm. Second patella and tibia, 6.6 mm; third, 3.6 mm; fourth, 5.8 mm.

*Variation.* The coxae may be light or dark or partly dark. The abdominal color pattern is variable (Figs. 166, 167). Total length of females 6.2 (New Hampshire) to 15.0 mm (Colorado), carapace 2.6 to 5.4 mm long, 2.0 to 4.5 mm wide. Total length of males 6.0 (New Hampshire) to 9.1 mm (Colorado), carapace 3.0 to 4.7 mm long, 2.6 to 3.8 mm wide. Alaska and New Hampshire specimens are smallest. New Hampshire males have an embolus that is shorter and wider, with a base more swollen and a tip slightly different from specimens in other localities. On the New Hampshire specimen's embolus tip, the distal teeth seem reduced to denticles and there is an opening of a short filiform portion. In contrast, the opening of Rocky Mountain males is on the top of a short flat portion (e in Fig. 173). Unfortunately there are no males from the northern Rocky Mountains, Alaska or the Arctic in the collections. Perhaps there are several species. But no consistent differences were found in epigyna; differences found (Figs. 182–186) did not vary with the abdominal color pattern, or other characters.

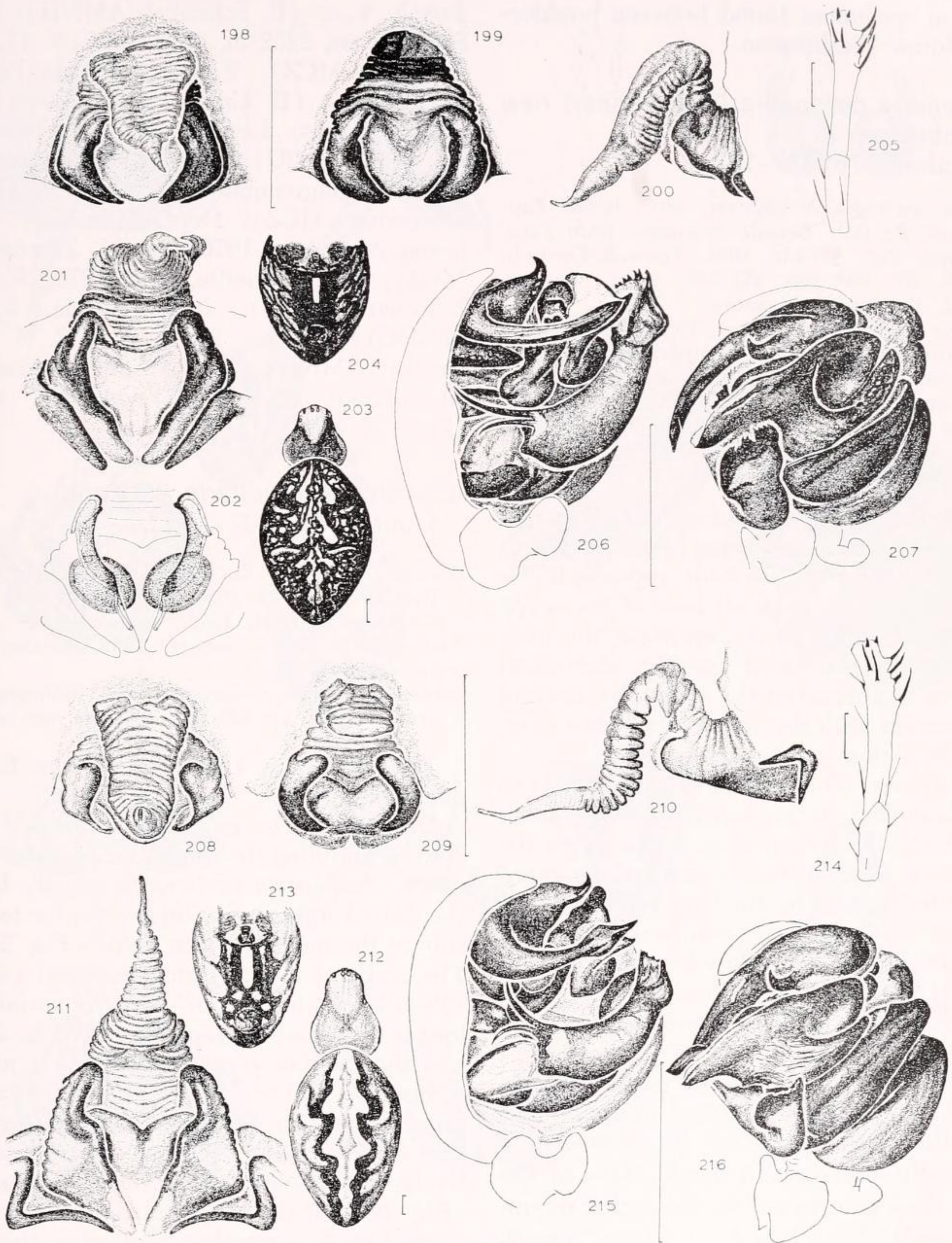
*Diagnosis.* Like *A. packardi*, this species can be confused with *Neoscona oaxacensis* (Keyserling), again because of the similar abdomen shape and dorsal pattern (Figs. 166, 167). The differences in the white ventral streak (Fig. 168) separate the two. However, the abdomen, unlike that of *A.*

*packardi*, does not have the lobes of the median band posteriorly directed (Figs. 166, 167). The scape of the epigynum is not torn off and is variable in shape but less than a third the width of the base (Figs. 162, 182, 185), and the conductor of the palpus is about three times as long as wide and lacks a ventral lip (Figs. 170, 172). The similar European *A. carbonaria* differs by having a wider scape (Figs. 198, 201) and differently shaped conductor of the palpus (Fig. 207).

*Natural History.* This species is fairly common in western Colorado where it makes its web between boulders of talus slopes, below and at the timber line (Plate 7). The web forms an angle with the vertical and the spider rests in the center, dropping out of the web at the slightest disturbance. It is then difficult to retrieve since the creature escapes down among rocks. After a few minutes, if undisturbed, it will climb back to the web by means of a thread it pulled out while falling. I have not seen the spider sit on stones on the side of the web. The web sites, 3000 to 3600 m elevation, probably have extremes of temperature in July from below freezing at night to up to 30° C during the day.

The species has been collected in Alaska "between rocks in pika [*Ochotona* sp.] area"; "among rocks at 1900 m" in the Yukon. The lowest elevation at which it has been collected in the American Rocky Mountains was in the Grand Tetons at 2800 m elevation. There are few males in collections, reflecting the difficulties of collecting spiders among the boulders.

*Distribution.* Central Siberia, Alaska to southern Rocky Mountains (Map 4) (apparently absent from the coast range) in the east on the Gaspé Peninsula and on Mount Washington, New Hampshire; both are areas that escaped glaciation and share many plant relicts. The easternmost record is from Mt. Cartier, Gaspé Peninsula, Quebec, 5 July 1959, ♀ (G. Argus, MCZ) at 1220 m in spruce-fir. Numerous records



Figures 198-207. *Aculepeira carbonaria* (L. Koch) (Switzerland. Fig. 200, Tyrol). 198-202. Epigynum: 198. Ventral. 199. Ventral, scape torn off. 200. Lateral. 201. Posterior. 202. Posterior, cleared. 203. Female dorsal, appendages removed. 204. Female abdomen, ventral. 205. Left second patella and tibia of male, dorsal. 206, 207. Left male palpus: 206. Mesal. 207. Ventral.

Figures 208-216. *A. armida* (Audouin) (Spain). 208-211. Epigynum: 208. Ventral. 209. Ventral, scape torn off. 210. Lateral. 211. Posterior. 212. Female, appendages removed. 213. Female abdomen, ventral. 214. Left second patella and tibia of male, dorsal. 215, 216. Male palpus: 215. Mesal. 216. Ventral.

Scale lines. 1.0 mm.

exist of specimens found between boulders on Mount Washington.

*Aculepeira ceropegia* (Walckenaer) new combination

Figures 175, 187–197

*Aranea ceropegia* Walckenaer, 1802, Faune Parisienne, 2: 199. Female specimens from Paris, France, lost. Wiehle, 1931, Tierwelt Deutschlands, 23: 100, figs. 151–155, ♀, ♂. Roewer, 1942, Katalog der Araneae, 1: 783.

*Araneus ceropegius*:—Bonnet, 1955, Bibliographia Araneorum, 2(1): 454 (European records only).

? *Araneus vachoni* Karol, 1964, Bull. Mus. Nat. d'Hist. Natur., ser. 2, 36: 188. Female holotype from near Ankara, Turkey, in the Muséum National d'Histoire Naturelle, Paris, examined. PROBABLE NEW SYNONYMY.

*Note.* This is a widespread Eurasian species that has not been found in North America. *Araneus vachoni* appears to be this species: the torn off base of the scape is as wide as that of *A. ceropegia*, the middle area is sclerotized and the abdominal pattern is characteristic. Only by finding a specimen with the scape intact, however, can the synonymy be determined.

*Diagnosis.* This species is very similar to the American *A. packardi*, having paired, upside-down, comma-shaped marks on the abdomen (Fig. 194). It can be separated from that species by the triangular scape of the female epigynum (which is frequently torn off), by the slightly sclerotized median area of the epigynum (Figs. 188–192) and by the very wide, deep conductor of the male (Fig. 197).

*Natural History.* According to Wiehle (1931) *A. ceropegia* is found in open areas with the web 50 cm above the ground; it is especially abundant in the foothills of the Alps, the Pyrenees and in the higher mountains to 3000 m. It is known from Scandinavia to the Mediterranean area.

*Examined Specimens.* Sweden. ♀ (NRS). Germany. Bremen, ♀ (SMF); Hessen: Eschwege, ♀ (H. Homann, SMF); Bavaria: Obersdorf, ♀ (SMF). Austria. Tirol. Weissenbach, ♂ (H. Wiehle, SMF). Switzerland. Zermatt, ♀, ♂ (SMF); Wallis:

Frisch, ♀, ♂ (E. Schenkel, AMNH); Uri: Susten Pass, 2232 m, 1875–1876, ♀ (J. H. Emerton, MCZ). France. Col de Portet d'Aspet, juv. (E. Crosby, CU); Dept. Pyrénées Hautes: Lac d'Ôo, 27 July 1932, ♀ (E. Crosby, CU); Dept. Pyrénées Orientales: Cerdagne many collections, 1976 (H. Zibrowius, MCZ); Dept. Vancluse: Luberon Mt., July 1976, ♀ (H. Zibrowius, MCZ); near Marseille, Aug. 1976, ♀ (H. Zibrowius, MCZ). Italy. Garda, ♀, ♂ (BMNH); Venice, 24 Aug. 1932, ♂ (E. Crosby, AMNH). Spain. San Lorenzo de El Escorial, ♀ (CU). Yugoslavia. Ipek [Pec], ♀ (SMF).

*Aculepeira carbonaria* (L. Koch)

Figures 198–207

*Epeira carbonaria* L. Koch, 1869, Z. Ferdinandeum, Tirol, third ser., 14: 168. Female specimens from Kütthai, Finstertal, Tirol., believed lost.

*Aranea carbonaria*:—Roewer, 1942, Katalog der Araneae, 1: 797.

*Araneus carbonarius*:—Bonnet, 1955, Bibliographia Araneorum, 2(1): 451 (European records only).

This species is known only from European mountains.

*Diagnosis.* The coloration is dark (Fig. 203), resembling the American *A. carbonarioides*. *Aculepeira carbonaria* usually lacks the paired light marks on the venter to the side of the median white stripe (Fig. 204). The scape of the epigynum is wider (Figs. 198–201) than that of *A. carbonarioides*, longer than that of *A. ceropegia* (Fig. 200) and the median area of the base is white (Figs. 199, 201); the palpal terminal apophysis tapers to the tip (Fig. 206), unlike that of *A. armida*. The conductor is relatively narrow with a deep distal depression (Fig. 207); it differs from that of *A. ceropegia* but is somewhat similar to that of *A. armida*.

*Natural History.* *Aculepeira carbonaria*, as far as is known, is also limited to talus slopes in the high mountains.

*Specimens Examined.* Austria. Tirol: Stubai, ♀, ♂ (L. Koch, BMNH). Switzerland. Wallis: Saas Tal, ♀, ♂ (E. Schenkel,

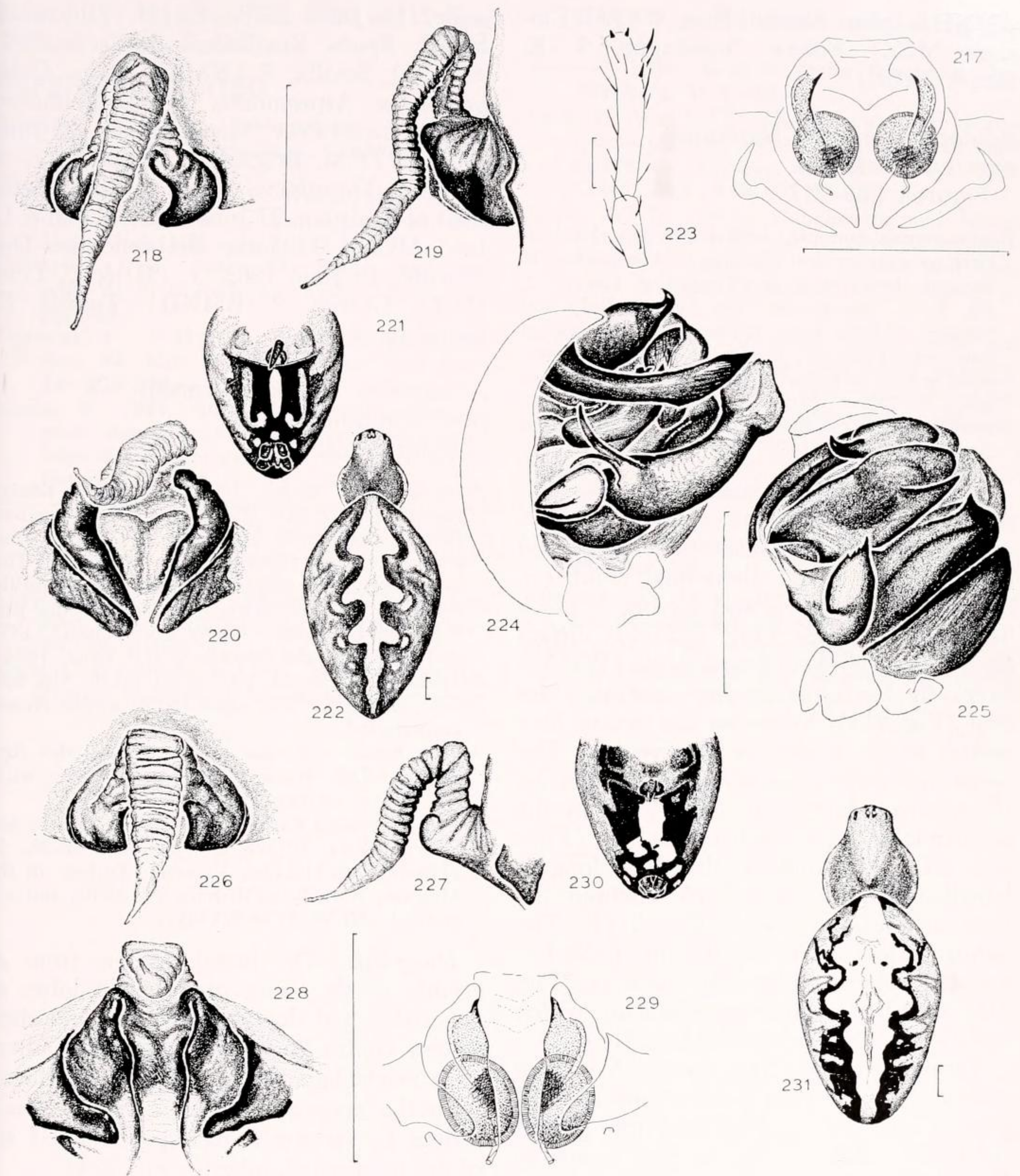


Figure 217. *Aculepeira armida* (Audouin) (France). Epigynum, posterior view, cleared.

Figures 218-225. *A. noseki* (Strand) (Turkey). 218-220. Epigynum: 218. Ventral. 219. Lateral. 220. Posterior. 221. Female abdomen, ventral. 222. Female, dorsal, appendages removed. 223. Male left second patella and tibia, dorsal. 224, 225. Male left palpus: 224. Mesal. 225. Ventral.

Figures 226-231. *Aculepeira* sp. (Samarkand). 226-229. Epigynum: 226. Ventral. 227. Lateral. 228. Posterior. 229. Posterior, cleared. 230. Female abdomen, ventral. 231. Female, dorsal, appendages removed.

Scale lines. 1.0 mm.

AMNH); Bern: Gemmi Pass, ♀ (J.H. Emerton, MCZ). *France*. "montagne," ♀ (E. Simon, MCZ).

*Aculepeira armida* (Audouin),  
new combination

Figures 208–217

*Epeira armida* Audouin, 1825 in Savigny, Explication sommaires des Planches d'Arachnides, in Savigny, Description de l'Égypte, p. 126, pl. 2, fig. 8, ♀. Specimens from France, Italy and vicinity of Acre [now northern Israel], lost. I here restrict the type locality to southern France.

*Aranea armida*:—Roewer, 1942, Katalog der Araneae, 1: 782.

*Araneus armidus*:—Bonnet, 1955, Bibliographia Araneorum, 2(1): 439.

*Note*. This Mediterranean species has not been found in America.

*Diagnosis*. The species can be recognized by the lobed dorsal abdominal band, enclosing a dark mark and having a black band on each side (Fig. 212). It differs from the similar *Neoscona adianta* (Walckenaer) by having a median ventral white spot (Fig. 213); *Neoscona* has two or four paired white marks on the venter. The epigynum differs from related species by the relatively long scape (Fig. 210), by the median lobe on each side of the base (Figs. 208, 209, 211), and by the thin elongate lamellae bent at right angles behind the base in posterior view (Fig. 211). The palpus differs by having the tip of the terminal apophysis wider than the neck (Fig. 215), and by the shallow conductor, which has distally a deeper area (Fig. 216).

*Natural History*. The species has been collected by sweeping prairies with isolated tufts of high grass in Italy and from grazed fields and brush and cypress-pine woods in Yugoslavia. Wiehle (1931) reports the species from low brush or grasses with the hub located, at most, at 50 cm above the ground. The web has a white, silk-covered hub and the retreat is flat, dish-shaped and open.

*Collections Examined*. *Switzerland*. Valais: Valère near Sion, ♀, ♂ (NMB). *France*. Luminy Col de Sugiton near Mar-

seille, 16 June 1976, ♀ (H. Zibrowius, MCZ). *Spain*. San Lorenz de Escorial, ♀, ♂ (CU); Sevilla, ♀ (NMB). *Italy*. Calabria Prov. Aspromonte, ♀ (E. Reimoser, MCZ); Lazio Prov. Monteromano, 21 June 1965, ♂ (P.M. Brignoli). *Sardinia*. ♀, ♂ (SMF). *Yugoslavia*. Istria: 5 km northwest of Vodrijan, 27 June 1962, ♂ (H. & L. Levi, MCZ); Dalmatia: Srebreno near Dubrovnik, 13 June 1962, ♀ (H. & L. Levi, MCZ). *Greece*. ♀ (BMNH). *Tunisia*. El Kairovan, ♂.

*Aculepeira noseki* (Strand),  
new combination

Figures 218–225

*Araneus similis* Nosek, 1905, Ann. Kais. Königl. Naturhist. Hofmus. Wien, 20: 131. Numerous female, male syntypes marked *A. kariae* from Erdschias-Dagh [Erciyas Dağ Mountain] Turkey in very poor physical condition in Naturhistorisches Museum, Wien, examined. (Name preoccupied by *Epeira similis* Taczanowski, 1873 and *Epeira similis* Bösenberg and Lenz, 1894). *Araneus noseki* Strand, 1907, Zool. Jahrb. Abt. System., 24: 396. New name for *A. similis* Nosek, preoccupied.

*Aranea kariae*:—Roewer, 1942, Katalog der Araneae, 1: 788. Roewer cites Strand, 1919, without further citation.

*Araneus karapagi* Karol, 1966, Comm. Facult. Sci. Univ. Ankara, 10 (ser. C): 111, figs. 1–28, ♀. Female from Hakkâri, Karadağ, Turkey, in the Muséum National d'Histoire Naturelle, not examined. NEW SYNONYMY.

*Diagnosis*. The female differs from *A. armida* in the more pronounced lobes of the abdominal dorsal band, the coloration is less contrasting (Fig. 222), and there are straight lamellae that are posterodorsal from the epigynum (Fig. 220); the male differs by having a half-spear-shaped tip of the terminal apophysis (Fig. 224).

*Natural History*. This species is also found in talus at and above timberline (K. Thaler, personal communication).

*Collections Examined*. *Turkey*. Erzurum-Palandöken, 2400 m elev., 8 Aug. 1970, ♀, ♂ (V. Sbordone, PB); Altiparmek, 2400 m, 30 Aug. 1964, ♀, ♂ (KT); Lasistan, Cigunet Yayla, 2500 m, 20 Aug. 1968, ♀ (H.

Gall, KT); Verschambek, 2800 m, 11 Aug. 1965, ♀ (H. Gall, KT).

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*Bulletin* OF THE  
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Zoology

The American Orb-weaver Genera  
*Colphepeira*, *Micrathena* and *Gasteracantha*  
North of Mexico (Araneae, Araneidae)

HERBERT W. LEVI

# THE AMERICAN ORB-WEAVER GENERA *COLPHEPEIRA*, *MICRATHENA* AND *GASTERACANTHA* NORTH OF MEXICO (ARANEAE, ARANEIDAE)

HERBERT W. LEVI<sup>1</sup>

**ABSTRACT.** *Colphepeira* has only one species from the southeastern United States. There are four species of *Micrathena* north of Mexico, three common ones in eastern North America from New England to the tropics, one uncommon from Arizona to Guatemala. All *Micrathena* known, perhaps 50 species, are tropical American, the three extending their range north belong each to a different species group. Even though tropical and widespread in the eastern states, *M. mitrata* and *M. gracilis* appear absent from southern Florida. All *Micrathena* species have only a sliver of the canoe-shaped tapetum left, the latter a characteristic of most of the superfamily Araneoidea. The cosmopolitan genus *Gasteracantha* has only one or two species in the Americas, *G. cancriformis* in the warmer parts of North America.

## INTRODUCTION

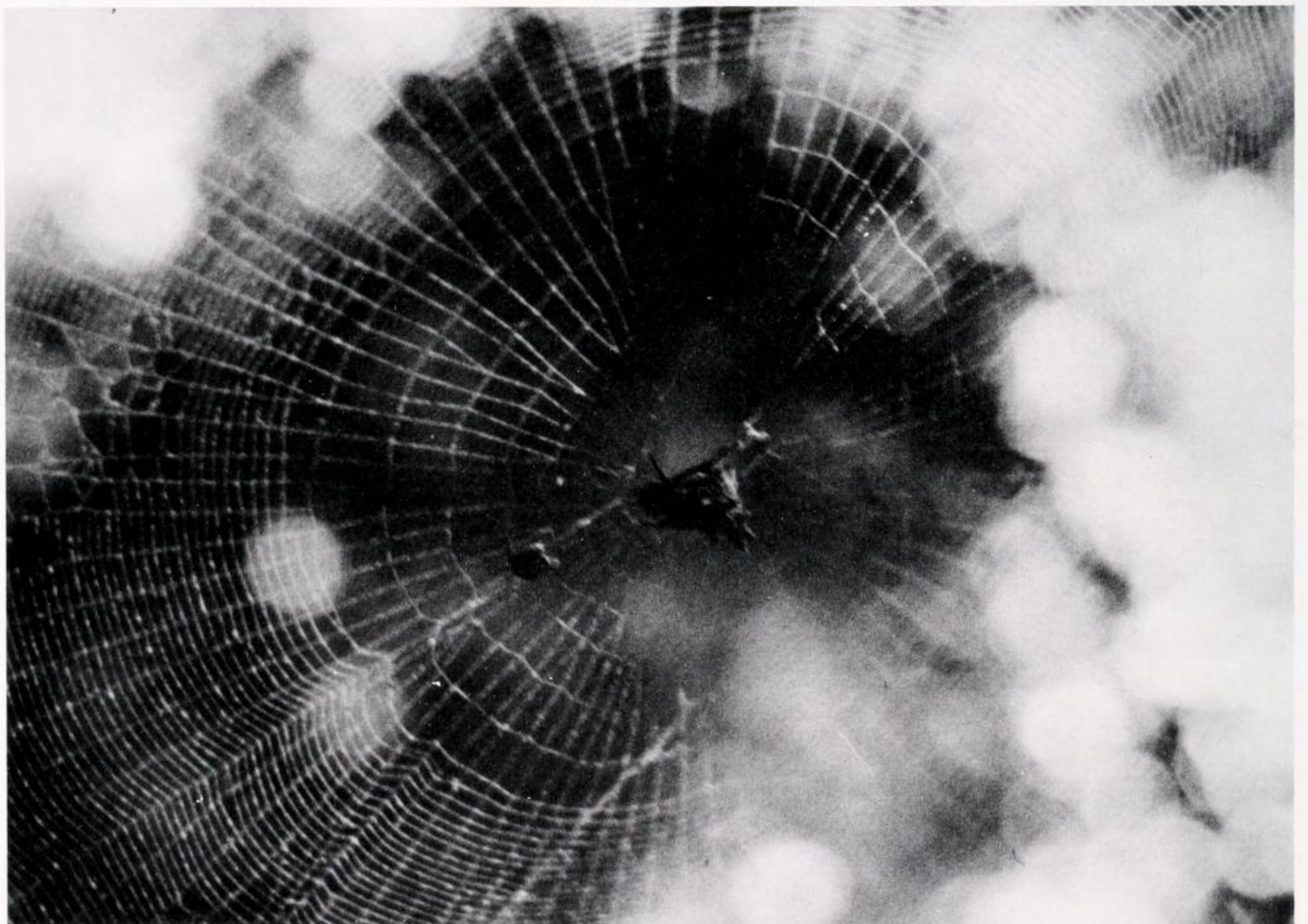
Homann (1950, 1971) reported diversity in secondary eye structure within the spider family Araneidae. The tapetum of the secondary eyes is usually canoe-shaped: with a crease through the middle dividing the tapetum into two parts facing each other (Figs. 4, 5, 75, 76). This is characteristic for members of the superfamily Araneoidea and some related families including Agelenidae, Gnaphosidae, Clubionidae, and Amaurobiidae. *Meta* and *Zygiella* have a large canoe-shaped tapetum, like Theridiidae, however the tapetum appears reduced in *Araneus* (and also *Colphepeira*, Figs. 4, 5) with rows of rhabdomes

arranged in loops toward the median side in the posterior median eyes. In some (*Pachygnatha*, and also *Linyphia*) only the lateral eyes have the canoe-shaped tapetum left. *Tetragnatha* have lost all tapetum. Some arachnologists consider the absence of epigynum in *Pachygnatha* and *Tetragnatha* a primitive feature and the two genera ancestral, related to the haplogyne spiders. Out-comparison (all relatives have a canoe-shaped tapetum, and an epigynum) would indicate that the loss of both structures may be secondary. To learn more about these relationships, the tapetum has to be examined (Figs. 4, 5, 19, 20, 75, 76).

Already Homann's eye studies indicated that *Colphepeira* belongs to the Araneinae, not close to *Meta* or *Theridiosoma* as previously thought. My study of *Colphepeira*'s genitalia confirms Homann's conclusions. A new observation, not previously reported, is that *Micrathena* species have only remnants of a tapetum in the posterior median eyes. Perhaps this is only an adaptation to *Micrathena*'s diurnal habits or perhaps it will be of use for figuring out phylogenies.

Also of interest are the relatively large accessory setae below the tarsal claws of *Micrathena*. *Micrathena* may be a good experimental animal for studying the handling of silk (a subject about which we know little), because its setae against which silk strands are held by the median claws are larger than those of other genera.

<sup>1</sup> Museum of Comparative Zoology.



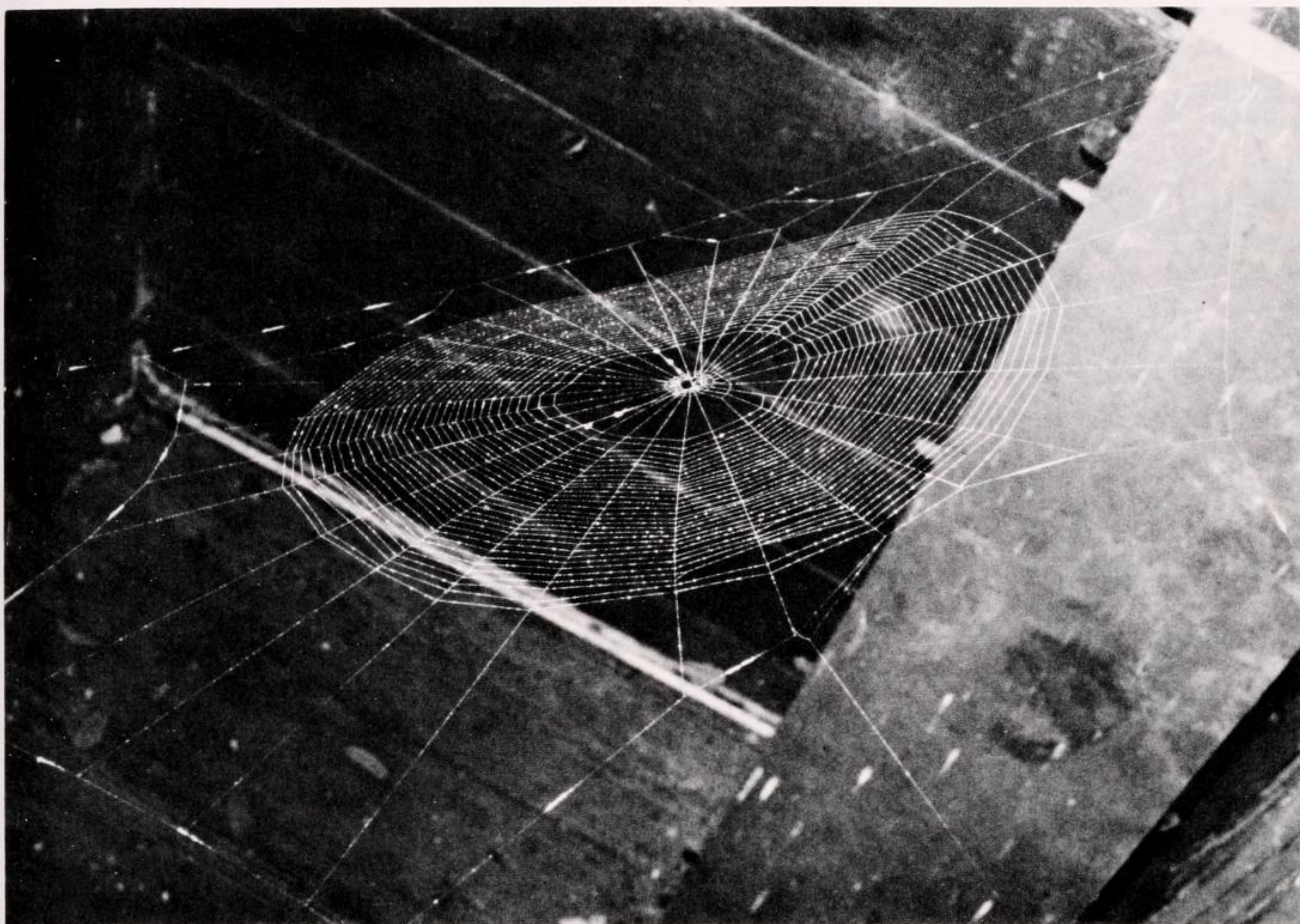


Plate 2. *Gasteracantha cancriformis* (Linnaeus) web, spider removed, dusted with cornstarch. Viscid area 17 cm in diameter. Web was built at 45° angle in porch corner of abandoned Florida house: lower left, floor; above and far right, walls. Notice tufts of silk on frame lines and on some radii.

*Colphepeira* contains only one small-sized species and is related to *Singa* and perhaps *Mangora*. *Micrathena* and *Gasteracantha* are tropical spiders; *Micrathena*, with more than 50 species, are all tropical American. Three of these have successfully extended their range from the tropics to temperate eastern North America (Map 2). Each of the three belongs to a different species group. I believe *Gasteracantha* and *Micrathena* to be specialized Araneidae which have lost some of their palpal sclerites secondarily, and *Micrathena* do not

attack-wrap prey (Robinson, personal communication). The lack of attack-wrapping is probably not primitive but a secondary loss. *Micrathena* and *Gasteracantha* orb-webs have open hubs (Plates 1, 2). *Micrathena* rests in the center of the web in an unusual position (Plate 1) and controls web tension. Unlike other araneid genera *Micrathena* have strong fourth legs, used to hold its position in the web (Plate 1). Both *Micrathena* and *Gasteracantha* are diurnal spiders.

I would like to thank colleagues for

←

Plate 1. *Micrathena gracilis* (Walckenaer) in web, Virginia. The lower photograph is about life-size. Web dusted with cornstarch. Notice the unusual position of the spider in the open hub and the use of the fourth leg (in upper photograph).

making collections available. P. H. Arnaud and R. X. Schick of the California Academy of Sciences, D. Bixler, J. A. Beatty, J. Carico, R. Crabill of the National Museum of Natural History, C. Dondale of the Canadian National Collections, S. I. Frommer of the University of California Riverside collections, W. R. Icenogle, B. J. Kaston, H. Dybas and J. B. Kethley of the Field Museum of Natural History, T. Kronestedt of the Natural History Museum, Stockholm, R. E. Leech, G. Uetz and J. D. Unzicker of the Illinois Natural History Survey, S. C. Johnson, W. Peck of the Exline-Peck collection, N. Platnick of the American Museum of Natural History, W. T. Sedgwick, W. Shear, W. Staręga of the Polish Academy of Science, Warsaw, H. K. Wallace, H. V. Weems of the Florida State Collection of Arthropods, F. R. Wanless of the British Museum, Natural History. The mapping and typing were done by Susan Hunt. The research and its publication were made possible by National Science Foundation grants BMS 75-05719 and DEB 76-15568.

## METHODS

The method of examination, study, and illustration are those of other studies in this series on North American orb-weavers. However in *Micrathena* and *Gasteracantha*, measurement of total length is the length in midline from the anterior margin of the carapace to between the posterior abdominal humps or spines.

The tapetum of the secondary eyes was examined by near-vertical illumination (with a fiber-light) on the eye. The spider is kept submerged in alcohol and positioned on washed sand, which permits odd positions and very minor changes in angles. (Because of reflections, sand is a poor background for most observations; the background should be black.) The magnification of the stereoscopic dissecting microscope is about 50 times for the larger species, 100 times for the smaller. If the eye lens has become opaque in preservation the spider can be cleared in clove oil for

examination. The posterior dorsal eyes were illustrated with the left eye flat and the right at an angle, anterior is on top (Figs. 4, 19, 75). The left lateral eyes were illustrated diagrammatically, first the anterior (left) flat under the microscope, then the spider was shifted for the posterior eye (right) flat under the microscope. The illustrations produced are thus composites (Figs. 5, 20, 76). The rows of rhabdomes can be seen in microscope mounts of the eyes with a compound microscope.

Following American and British dictionary definitions but not arachnological vocabulary, spines are immovable, rigid, pointed humps or thorns, as found on the abdomen of *Micrathena* and *Gasteracantha*. The movable heavy setae covering the integument are called macrosetae.

## *Colphepeira* Archer

*Colphepeira* Archer, 1941, Geol. Surv. Alabama, Mus. Paper, 18: 12. Type species *Epeira cawba* Banks by original designation. The name is feminine.

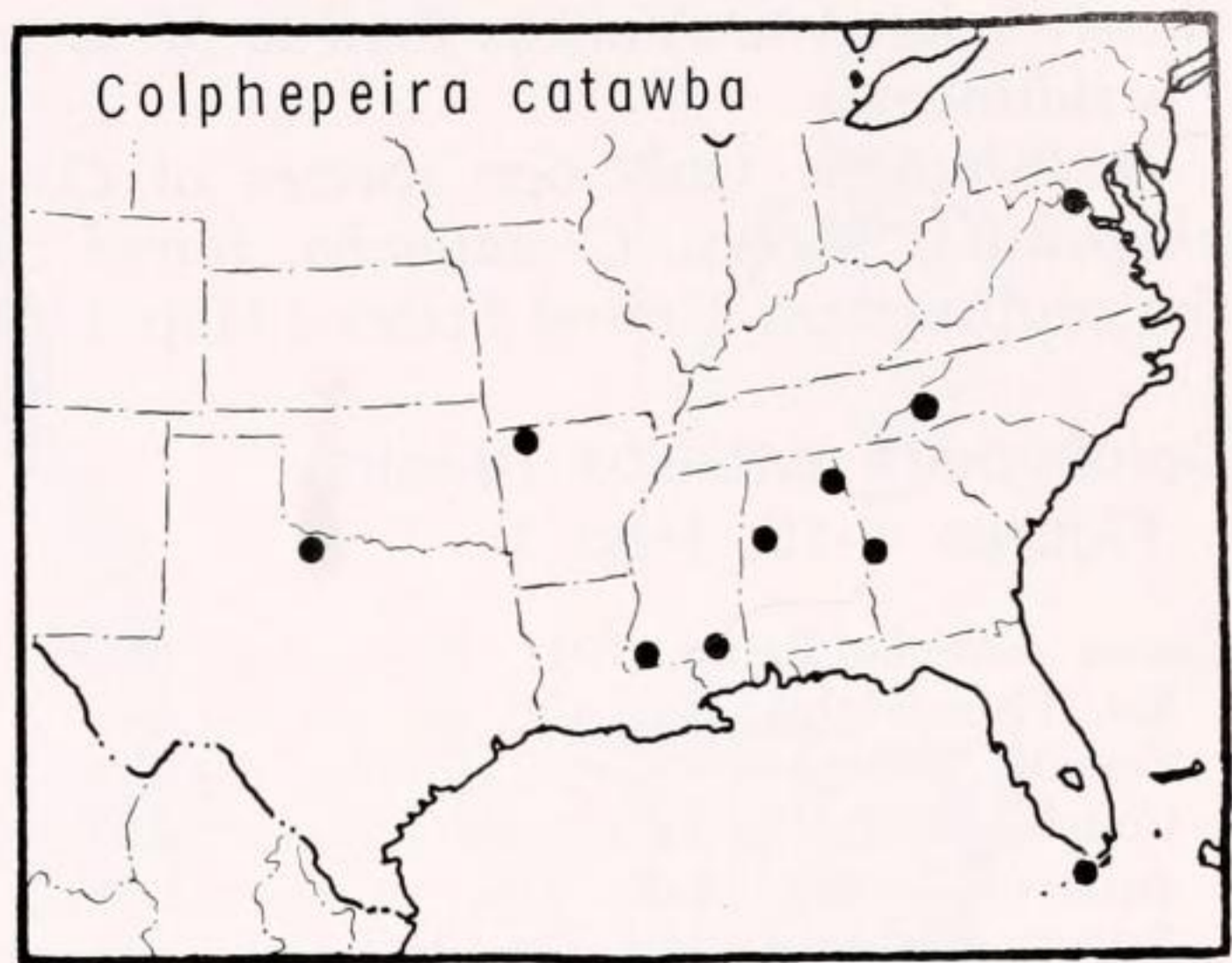
*Diagnosis.* *Colphepeira* differs from many other araneid genera by the closely spaced eyes (Figs. 1-3). Unlike *Mangora* and *Singa*, it has a hirsute carapace and abdomen with short setae on granules and the shape of the abdomen is higher than long with posterior dorsal tubercles (Figs. 1, 6, 7). It differs from *Mangora* by the lack of the characteristic long trichobothria on the third tibia.

*Description.* The carapace, abdomen, and legs are covered with scattered short setae. The setae are cylindrical, distally tapering to a blunt point, basally with a narrow neck and sitting in the center of a disc. The sides of the setae have some blunt teeth (Fig. 9). The eyes are subequal to each other in the female, and the anterior are larger in the male. The posterior eye row is recurved. The median eyes are slightly more than their diameter apart, and the anterior medians are less than two diameters from the laterals, the posterior medians 2.5 diameters from the laterals.

The thorax has a shallow depression in the female (Fig. 3) and a transverse, procurved mark in the male. The posterior part of the head is slightly swollen. The height of the clypeus is slightly more than the diameter of the anterior median eyes (Fig. 2). The sternum, like the carapace, is lightly sclerotized and slightly granulate. The chelicerae are weak, without a basal boss, and have two teeth on the anterior margin, two on the posterior and denticles and one tooth in between (Fig. 8). The chelicerae have a proximal anterior projection under the clypeus as in Theridiidae (Fig. 8). The proximal articles of the legs, especially the femora, are also slightly granulate. The first legs are longest, the fourth second in length, the third shortest. The metatarsus and tarsus together are shorter than the patella and tibia. The abdomen is higher than long with posterodorsal and posterior tubercles (Figs. 1, 6, 7). The lung covers are smooth and, like those of *Meta*, lack the transverse grooves found in species close to *Araneus*. The leaflets of the book-lung in a microscope mount appear to consist of series of parallel tracheae attached to each other side by side.

The males are like females, slightly smaller and have a more distinct, transverse, thoracic depression and a slightly higher clypeus, 1.5 diameters of the anterior median eyes. The endite has a tooth facing a tooth on the proximal end of the palpal femur. The distal margin of the first coxa has a hook that fits into a groove on the second femur. The legs are not modified except that the anterior tibia is slightly sinuous.

**Genitalia.** The soft epigynum is covered with setae (Fig. 9) and has a soft annulate scape (Figs. 9, 10). The openings appear on the posterior face (Figs. 10, 11). There are fertilization ducts. The male palpus has a soft conductor (C in Figs. 14, 15), bearing a basal tooth, a median apophysis (M), which has a hook, and a very large terminal apophysis (A) which covers conductor and embolus (E) distally. The



Map 1. Distribution of *Colphepeira catawba* (Banks), north of Mexico.

terminal apophysis extends and covers most of the bulb laterally (Figs. 12–15).

**Relationship.** A similar large terminal apophysis (A in Fig. 15) is found in some species of *Singa* (Levi, 1972) and *Mangora* (Levi, 1975). The resemblance of the palpus (Fig. 14) to that of *Singa hamata* (Clerck) is striking in the shape of the small median apophysis (M), the soft conductor (C), and the large terminal apophysis (A). The embolus of *Colphepeira* is simpler, and *Colphepeira* lacks a subterminal apophysis. Other similarities to *Singa hamata* and *Mangora* are the lightly sclerotized epigynum, with a soft broadly attached scape and the closely spaced eyes. The genitalia also resemble those of *Cercidia* (except for *Cercidia*'s large median apophysis). All these related genera *Colphepeira*, *Singa*, *Mangora*, and *Cercidia* have the eyes relatively closely spaced, unlike those of the larger-sized *Araneus*, *Micrathena*, *Gasteracantha* and those of numerous other araneid genera. *Colphepeira*, unlike most araneid genera but like *Mangora*, does not have distinct contrasting ventral abdominal marks.

After he examined the tapetum of the secondary eyes (Figs. 4, 5) Homann (1950) first reported that *Colphepeira* is more

closely related to *Araneus* than to *Meta* or *Theridiosoma*.

*Distribution.* Only one species of *Colphepeira* is known, *C. catawba*, found in the southeastern United States (Map 1).

### *Colphepeira catawba* (Banks)

Figures 1–15; Map 1

*Epeira catawba* Banks, 1911, Proc. Acad. Natur. Sci. Philadelphia, 63: 450, pl. 34, fig. 4, ♀. Female holotype from Ashville, Buncombe County, North Carolina in the Museum of Comparative Zoology, lost. There is no old E. B. Bryant catalog card in the file for this species as there is for other Banks types.

*Aranea catawba*:—Roewer, 1942, Katalog der Araneae, 1: 859.

*Colphepeira catawba*:—Archer, 1941, Geol. Surv. Alabama, Mus. Paper, 18: 13, pl. 1, figs. 3, 4, pl. 2, figs. 1–3. 1953 Amer. Mus. Novitates, no. 1622: 22, figs. 32–34.

*Araneus catawba*:—Bonnet, 1955, Bibliographia Araneorum, 2: 452.

*Description.* Female from Arkansas: carapace black with paired yellowish white patches lacking pigment. Sternum spotted black and yellow-white. Coxae yellow-white. Legs yellow-white with narrow black rings. Dorsum of abdomen with paired streaks (Figs. 1, 7). Venter with black and white spots and no distinct marks. The abdomen slightly higher than long, with four posterodorsal tubercles closely grouped on each side and a pair of tubercles on the posterior face (Fig. 7). Total length, 3.5 mm; carapace, 1.2 mm long; 1.0 mm wide. First femur, 1.2 mm; patella and tibia, 1.4 mm; metatarsus, 1.3 mm; tarsus, 0.5 mm. Second patella and tibia, 1.2 mm; third, 0.8 mm; fourth, 1.0 mm.

Male from Arkansas with color pattern less distinct than female. Abdomen shape like that of female. Total length, 1.6 mm; carapace, 0.9 mm long, 0.9 mm wide. First femur, 1.0 mm; patella and tibia, 1.2 mm; metatarsus, 0.6 mm; tarsus, 0.4 mm. Second

patella and tibia, 1.1 mm; third, 0.6 mm; fourth, 0.7 mm.

*Variation.* Some specimens have little black pigment, others are almost completely black. Total length of females 2.2 to 3.8 mm; carapace 1.0 to 1.3 mm long, 0.9 to 1.1 mm wide. Total length of males, 1.6 to 2.2 mm; carapace 0.9 to 1.2 mm long, 0.9 mm to 1.0 mm wide.

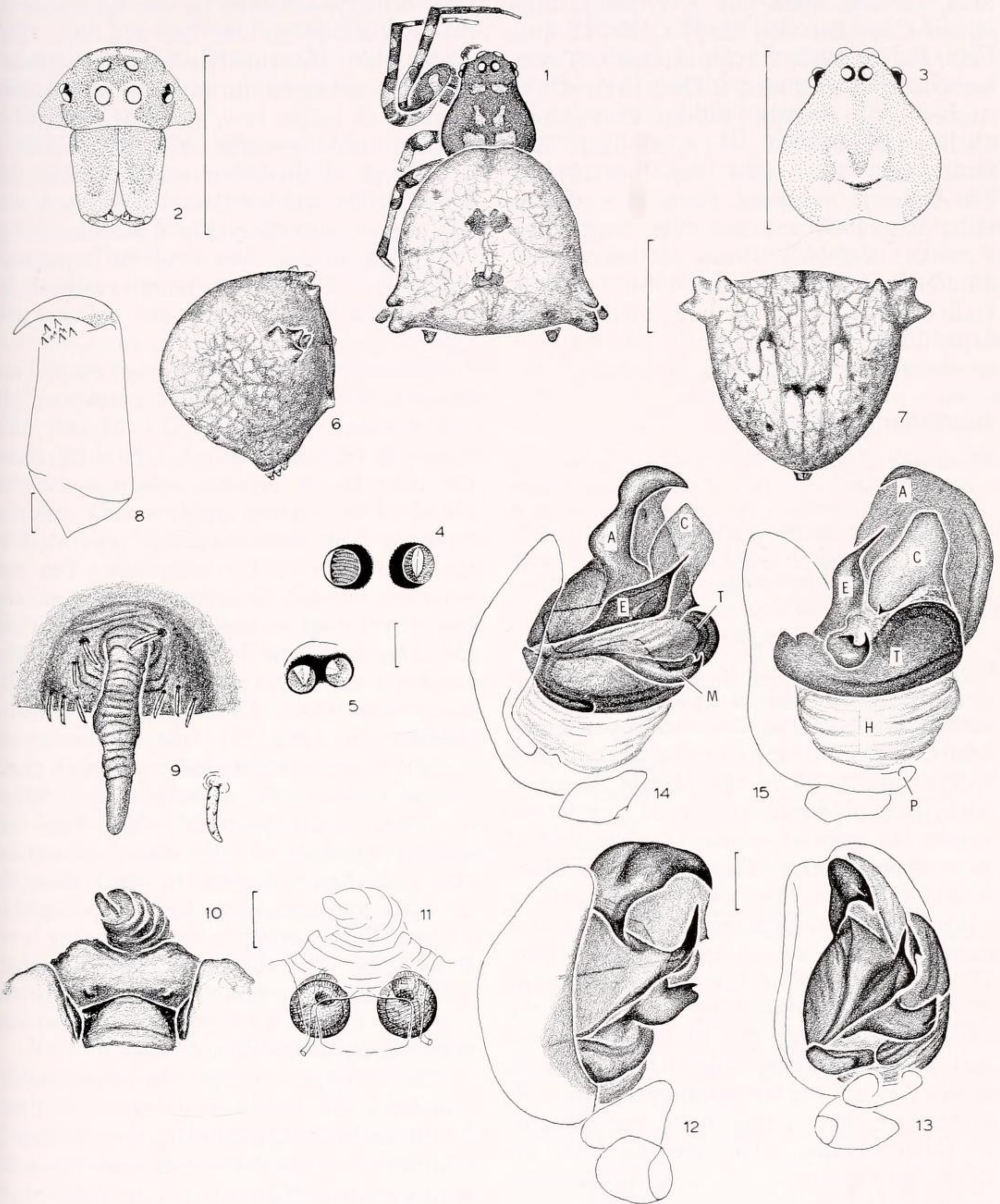
*Diagnosis.* This species can only be confused with *Dolichognatha* species, which are of similar size and appearance. *Dolichognatha*, a relative of *Tetragnatha*, has four small tubercles on the abdomen, and *Colphepeira* has four tubercles posterodorsal on each side and in addition a pair posteriorly (Figs. 1, 6, 7). *Dolichognatha* species have their chelicerae elongate; *Colphepeira* do not (Fig. 2). The *Dolichognatha* epigynum has a depression with a dark spot on each side; *Colphepeira* has a fleshy scape (Figs. 9, 10). The *Dolichognatha* male palpus appears rather simple, *Tetragnatha*-like, but with a complicated paracymbium. That of *Colphepeira* has a terminal apophysis, median apophysis, and a simple paracymbium (Figs. 12–15).

*Natural History.* According to Archer (1941) *Colphepeira catawba* makes its horizontal orb-web near the ground between tree roots in thin open second-growth woods with grassy undergrowth. The web is 7 to 9 cm diameter with about 60 spirals and a small, poorly defined hub. The egg-sac hangs with debris, suspended on a horizontal line just above the web. The spider has its retreat under loose bark and feeds on small ants.

*Distribution.* Southeastern United States, Virginia, southern Florida to Sonora (Map 1).

*Records.* Virginia. Fairfax Co.: Great Falls, ♀ (N. Banks). Georgia. Troup Co.: West Point, 7 Sept. 1949, ♀ (A. Archer). Florida. Monroe Co.: 2 mi SE of Mara-





terior. 11. Posterior view, cleared. 12-15. Male, left palpus. 12. Mesal. 13. Ventral. 14. Mesal, expanded. 15. Ventral, expanded.

Scale lines. 0.1 mm, except Figures 1-7, 1.0 mm.

Abbreviations. A, terminal apophysis; C, conductor; E, embolus; H, hematodocha; M, median apophysis; P, paracymbium; T, tegulum.

thon, 15 Dec. 1962, juv. (W. Ivie). *Alabama*. Cherokee Co.; May's Gulfe, 11 Aug. 1948, 13 Oct. 1949, ♀♀ (A. Archer). *Tuscaloosa Co.*: Tuscaloosa, 2 Oct. 1941, ♀ (A. Archer). *Mississippi*. Forrest Co.: Camp Shelby, 1945–1946, ♀, ♂ (A. Archer). *Wilkinson Co.*: Centreville, Jan.–July 1944, ♀ (A. Archer). *Arkansas*. Carroll Co.: Berryville, Aug. 1938, summer 1941, Sept. 1944. ♀, ♂ (C. Wilton). *Texas*. Wilbarger Co.: 4 mi NW of Elliott, 21 Oct. 1964, ♂ (K. W. Haller). *Sonora*. Guaymas, on beach, 13 Sept. 1966, ♀ (J., W. Ivie), not mapped, received after completion of paper.

### *Micrathena* Sundevall

*Micrathena* Sundevall, 1833, *Conspectus Arachnidum*, London, p. 14. Type species *Epeira clypeata* Walckenaer, the only species listed in "section one" of the genus. The name is feminine. The synonymy problems of generic names are discussed by Bonnet, 1957 (*Bibliographia Araneorum*, 2: 2858).

**Diagnosis.** *Micrathena* females differ from those of other genera in having a smooth, shiny carapace with a light rim on each side (Figs. 18, 31, 45, 59) and in particular, from *Gasteracantha*, by having the carapace longer than wide in the female, at times with pairs of dimples (Fig. 31) or lateral spines (in tropical species) unlike that of any other genera. The female abdomen is usually longer than wide, trapezoidal, or square armed with spines, sclerites and a sclerotized ring around the spinnerets (Figs. 17, 30, 44, 58), while that of *Gasteracantha* is usually wider than long. Males lack the carapace rim and the abdominal spines and have a smooth, sclerotized abdomen with a ring around the spinnerets. The male abdomen is longer than wide, not like that of *Gasteracantha*. The median eyes are never projecting as are those of *Gasteracantha*. The posterior legs of both sexes, especially the femora, are longer than the anterior legs or subequal in length, unlike those of most other araneid genera. The posterior median eyes have the canoe-shaped tapetum reduced to a very narrow, lateral sliver. When viewed through the

lens, it may be hidden by the curvature of the eyeball (Figs. 19, 32, 46, 60). The mesal side contains rhabdomes without tapetum, arranged in rows of a variable number of loops, few, perhaps 5 to 6 in number in *M. gracilis* (Fig. 60), about 8 to 9 loops in the other species (Figs. 19, 32, 46). The narrow lateral tapetum is unlike that of most species of Araneidae (Fig. 75). The lateral eyes may be separated from each other by as much as their diameter; the rhabdomes to the sides of the tapetum are not arranged in rows.

**Description.** The carapace is smooth and shiny in the female and has a unique light rim on each side (Figs. 18, 31, 45, 59). Posterior median eyes are 1.2 to 1.5 times the diameter of anterior medians, laterals subequal or slightly smaller than anterior medians. The median eyes are separated by their diameter to 1.5 diameters. The laterals are several diameters from medians, but may be up to slightly more than their diameter from each other (Fig. 47). The height of the clypeus is equal to or slightly more than the diameter of the anterior median eyes (Fig. 57). The chelicerae are slightly longer than wide, strong with three to four teeth on the anterior margin, three to four on the posterior. The legs are usually not banded. However, sometimes they are slightly lighter in color than the carapace and sometimes slightly granulated (especially the long femora) bearing very short setae. The abdomen is often brightly colored, always modified with spines, tubercles, or folds. The spinnerets are surrounded by a sclerotized ring.

The males are smaller than the females and have the abdomen lightly sclerotized. In the males, it is greater in length than in width, but lacks the spines and tubercles of the female. Thus it is quite difficult to associate with the females of the same species (Figs. 16, 28, 41, 55). The palpal femur lacks the proximal tooth, and there is no facing tooth on the endite. The first coxae sometimes have a hook, sometimes not; the hook is absent in the four species

north of Mexico. The distal articles of the legs may not be modified and only sometimes have macrosetae; in *M. funebris* the first femur has macrosetae on the distal end (Fig. 16).

*Genitalia.* The epigynum is usually a heavily sclerotized knob with openings at the base of the posterior face (Figs. 21–23, 34–36, 48–50, 62–64). There is no annulate scape. Together with the shape of the abdomen, the epigynum is a diagnostic feature but has been slighted by previous authors.

The palpal patella has one macroseta in *M. funebris*; in *M. gracilis* and *M. sagittata* the macroseta is present, but small. The paracymbium (P in Fig. 40) differs in different species (Figs. 25, 38, 52, 66), unlike other araneid genera but as in *Zygiella*. The bulb lacks a terminal apophysis but has a transparent flap which arises from the base of the embolus (E) and surrounds it. It may be homologous with the missing terminal apophysis (Figs. 27, 40, 54, 68). The embolus tip (E) rests in the conductor (C). The conductor is sometimes a complex sclerite and at its base another sclerite may appear, the paramedian apophysis (PM) (Figs. 40, 68). The median apophysis varies greatly in different species: a sclerotized, split hook in *M. funebris* (M in Fig. 27), the tip sclerotized in *M. mitrata* (Fig. 40), forked in *M. sagittata* (Fig. 54) and reduced in *M. gracilis* (Fig. 68). The sclerites of the palpus are only lightly sclerotized, unlike the sclerotized epigynum, carapace and spines.

*Natural History.* *Micrathena* species are diurnal and the spiders rest in the open hub of the orb-web (Plate 1). The spider hangs in a characteristic position, controlling the tension of the web while in the hub. The spinnerets are up, the dorsal surface of the abdomen parallel to the ground (Plate 1) and at an angle to the web plane. The orb has many radii and spirals. No doubt the long fourth legs are an adaptation to the unusual position in the web. Unlike most araneids, *Micrathena* species do not

attack-wrap (M. Robinson, personal communication). There is no retreat. All species, north of Mexico, mature in fall in the northern part of their range. Little is known of egg-sacs and life histories.

*Distribution.* All species known are American. There may be as many as 50 or more tropical American species, with only four extending their range into the temperate area north of Mexico: three in the eastern United States, one in the Southwest (Map 2).

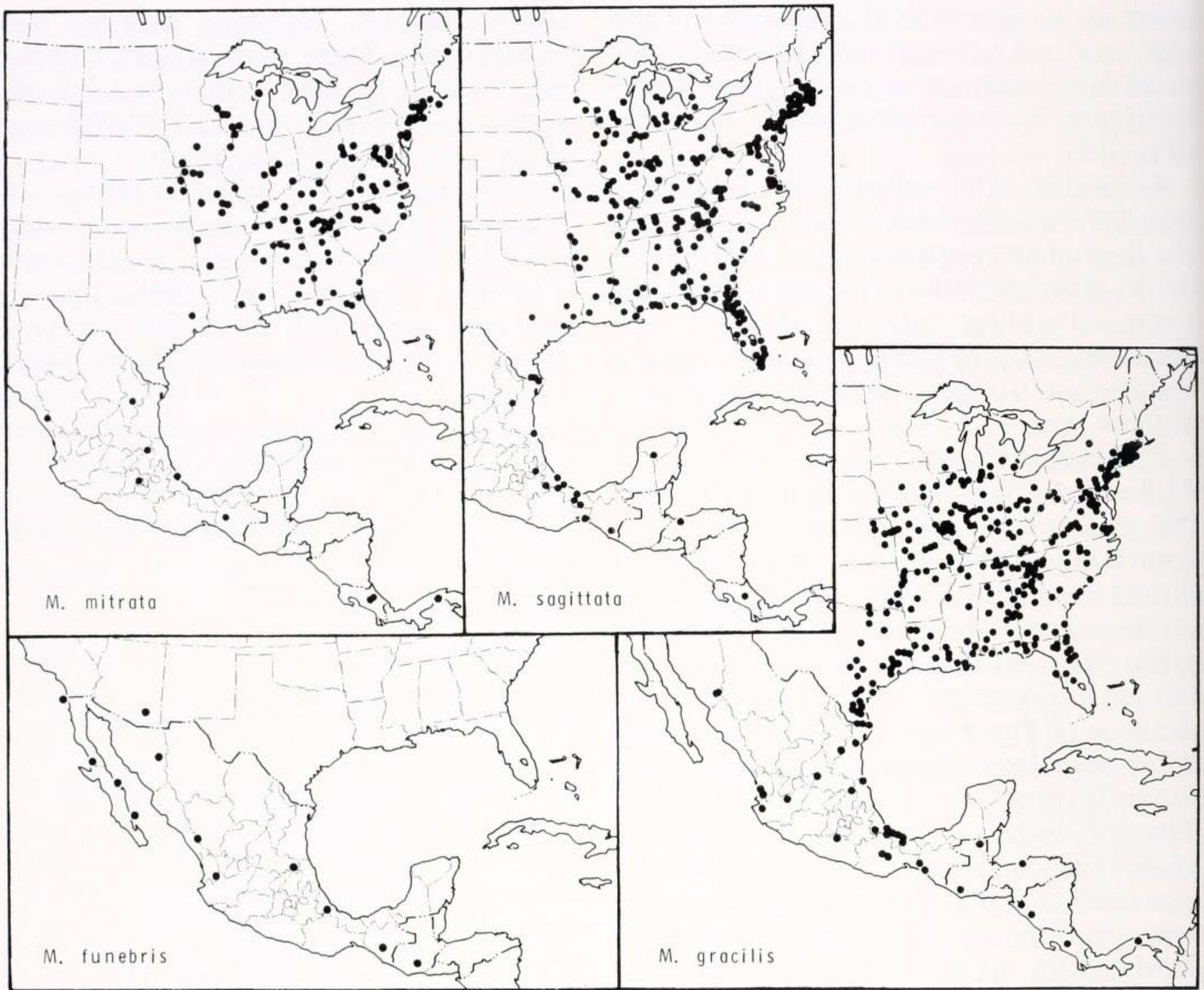
*Note.* In all species, the genitalia are quite variable, and thus the species are difficult to delineate. The four species north of Mexico, however, are not closely related to each other and are easily separated.

#### KEY TO FEMALE *MICRATHENA* NORTH OF MEXICO

1. Female abdomen with 5 pairs of conical tubercles (Figs. 58, 59); eastern United States to South America ..... *gracilis*
- Female abdomen with 3 or 2 pairs of spines or tubercles (Figs. 18, 31, 45) .... 2
- 2(1) Abdomen with only two pairs of posterior conical tubercles (Figs. 30, 31); carapace with 3 pairs of dimples (Fig. 31); eastern United States to South America (Map 2) ..... *mitrata*
- Abdomen with 3 pairs of tubercles or spines (Figs. 17, 44, 45) and carapace without paired dimples (Figs. 18, 45) .... 3
- 3(2) Abdomen much wider behind than anteriorly and with anterior, lateral and large posterior, dorsal spines (Figs. 44, 45); eastern United States to South America (Map 2) ..... *sagittata*
- Abdomen as wide behind as in front without anterior dorsal spines or tubercles, but with dorsolateral, posterior dorsal and posterior ventral tubercles (Figs. 17, 18); Arizona, Baja California to Central America (Map 2) ..... *funebris*

#### KEY TO MALE *MICRATHENA* NORTH OF MEXICO

1. Abdomen wider behind than in front (Fig. 41); median apophysis of palpus with two branches (Figs. 53, M in 54); paracymbium a recurved hook pointing dorsally (Fig. 52); eastern United States to South America (Map 2) ..... *sagittata*
- Abdomen as wide behind as in front (Figs. 16, 28, 55); median apophysis and paracymbium otherwise (Figs. 26, 39, 67) ..... 2



Map 2. Distribution of *Micrathena* species north of Mexico.

- 2(1) Abdomen more than twice as long as carapace (Fig. 55); posterior end of abdomen longer on venter than dorsum (Fig. 56); eastern United States to South America (Map 2) ..... *gracilis*
- Abdomen less than 1.5 times as long as carapace, not longer on venter (Figs. 16, 28, 29) ..... 3
- 3(2) First femur with distal macrosetae (Fig. 16); paracymbium with large granulate sculpturing (Fig. 25); median apophysis a semicircular hook on proximal end of bulb (Figs. 26, M in 27); Arizona, Baja California to Central America (Map 2) ..... *funebris*
- First femur without distal macrosetae (Fig. 28); paracymbium smooth and small (Fig. 38); median apophysis with distal end pointed and bent back (Figs. 39, M in 40); eastern United States to South America (Map 2) ..... *mitrata*

*Micrathena funebris* (Marx in Banks)  
 Figures 16-27, Map 2

*Acrosoma funebre* Marx in Banks, 1898, Proc. California Acad. Sci., 3rd ser., 1(7): 249. Female syntypes from Calmilla Mines and Sierra San Nicholas in the California Academy of Sciences, destroyed; and two syntypes from Mazatlan in the Museum of Comparative Zoology, examined.

*Acrosoma maculata* Banks, 1900, Canadian Entom., 32: 100. Female holotype from "Arizona" in the Museum of Comparative Zoology, examined. NEW SYNONYMY.

*Micrathena granulata* F.P.-Cambridge, 1904, Biologia Centrali-Americana, Araneidea, 2: 532, pl. 50, fig. 12, ♂. Male holotype from Teapa, Mexico in the British Museum, Natural History, examined. Reimoser, 1917, Verh. Zool. Bot. Ges. Wien, 67: 117. Roewer, 1942, Katalog der Araneae, 1: 958. Bonnet, 1957, Bibliographia



Figures 16-27. *Micrathena funebris* (Marx in Banks). 16. Male. 17-24. Female. 17. Lateral. 18. Dorsal. 19. Posterior median eyes. 20. Left lateral eyes. 21-24. Epigynum. 21. Ventral. 22. Posterior. 23. Lateral. 24. Posterior, cleared. 25-27. Male left palpus. 25. Lateral. 26. Mesal. 27. Submesal, expanded.

Scale lines. 0.1 mm; except Figures 16-18, 1.0 mm.

Abbreviations. C, conductor; E, embolus; H, hematodocha; M, median apophysis; R, radix; S, subtegulum; T, tegulum; Y, cymbium.

Araneorum, 2: 2870. Chickering, 1961, Bull. Mus. Comp. Zool., 125(13): 423, figs. 78-82, ♂. NEW SYNONYMY.

*Micrathena funebris*:—Reimoser, 1917, Verh. Zool. Bot. Gesell. Wien, 67: 104. Roewer, 1942, Katalog der Araneae, 1: 958. Bonnet, 1957, Bibliographia Araneorum, 2: 2867. Chickering, 1961, Bull. Mus. Comp. Zool., 125(13): 414, figs. 55-59, ♀.

*Micrathena maculata*:—Reimoser, 1917, Verh. Zool. Bot. Gesell. Wien, 67: 10. Roewer, 1942, Katalog der Araneae, 1: 967. Bonnet, 1957, Bibliographia Araneorum, 2: 2871. NEW SYNONYMY.

*Note.* Chickering (1961) already suspected that the male named *M. granulata* belonged to the female *M. funebris*.

*Description.* Female holotype of *M. maculata*. Carapace brown, sternum black-brown. Legs much lighter, yellow-brown, indistinctly banded darker. Abdomen black with white patches (Fig. 18). The rim of the carapace is brown. Carapace with a circular depression in thorax (Fig. 18). Abdomen soft with four fleshy extensions posteriorly and an anterior pair of humps on each side (indistinct, if viewed from above, Figs. 17, 18). Total length 7.0 mm, carapace 2.3 mm long, 1.6 mm wide. First femur, 2.0 mm; patella and tibia, 2.2 mm; metatarsus, 1.5 mm; tarsus, 0.7 mm. Second patella and tibia, 1.9 mm; third, 0.9 mm. Fourth femur, 2.4 mm; patella and tibia, 2.2 mm; metatarsus, 1.6 mm; tarsus, 0.7 mm.

Male from Sonora: Carapace glossy brown; legs brown. Dorsum of abdomen gray with central white spots and a row of white spots along lateral margins (Fig. 16); sides gray; venter with a plate from pedicel and surrounding spinnerets lightly sclerotized and brownish black. First femur with strong macrosetae at distal end (Fig. 16). Sides of abdomen almost parallel (Fig. 16). Total length 4.1 mm, carapace 1.7 mm long, 1.1 mm wide. First femur, 1.6 mm; patella and tibia, 1.5 mm; metatarsus, 1.0 mm; tarsus, 0.5 mm. Second patella and tibia, 1.4 mm; third, 0.8 mm. Fourth femur, 1.6 mm; patella and tibia, 1.4 mm; metatarsus, 1.1 mm; tarsus, 0.5 mm.

*Variation.* The palpus of males from

southern Mexico and Guatemala differs in having a shorter sclerotized portion of the median apophysis and a more sclerotized paramedian apophysis. Females vary in total length 5.8 to 7.2 mm, carapace 2.4 to 2.6 mm long, 1.5 to 1.7 mm wide. Males vary in total length 4.0 to 4.1 mm, carapace 1.7 to 2.0 mm long, 1.1 to 1.3 mm wide.

*Diagnosis.* This species is similar to *M. mitrata*. Females differ in their lack of the paired dimples on the carapace (Fig. 18), and the openings of the epigynum are not in a depression (Figs. 22, 24). There is a pair of tubercles anterodorsal on the abdomen (Fig. 17), lacking in *M. mitrata*. The male palpus differs from *M. mitrata* in having a large granulate paracymbium (Fig. 25) and a split sickle-shaped median apophysis on the proximal end of the palpal bulb (Figs. 26, M in 27).

*Natural History.* Specimens have been collected sweeping weeds at 975 m elevation in Sonora. The webs in Arizona were fairly abundant and were found one to two feet from the ground, attached to stems of Johnson grass (*Sorghum halepense*). They were found near water, at a 825 m elevation (J. Beatty, personal communication).

*Distribution.* From Baja California and Arizona to Guatemala (Map 2).

*Records* (north of Mexico). *Arizona.* Pima Co.: Sabino Pond, Santa Catalina Mts., 825 m el. 26 June, 1960, ♀♀; 10 July 1962, ♀♀ (J. Beatty).

### *Micrathena mitrata* (Hentz)

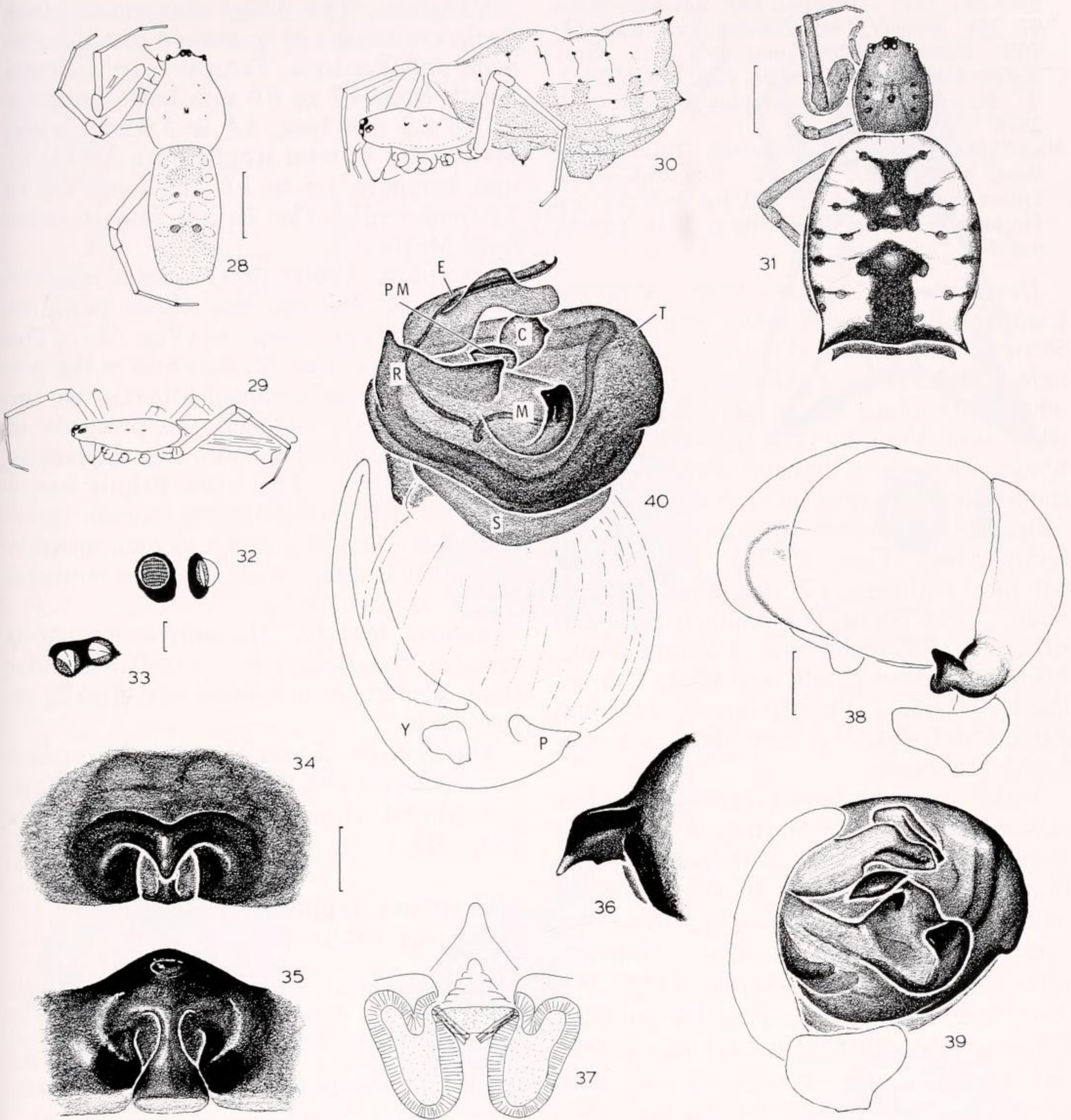
Figures 28-40, Map 2

*Epeira mitrata* Hentz, 1850, J. Boston Natur. Hist. Soc., 6: 22, pl. 3, fig. 11, ♀. Syntypes from North Carolina and Alabama in the Boston Society of Natural History, destroyed.

*Acrosoma mitrata*:—Emerton, 1884, Trans. Connecticut Acad. Sci., 6: 327, pl. 38, fig. 9, ♀. Emerton, 1902, Common Spiders, p. 189, fig. 438. ♀.

*Acrosoma redivianum*:—McCook, 1893, American Spiders, 3: 213, pl. 21, figs. 6, 7, ♀, ♂. Not *Plectana rediviana* Walckenaer, 1841 (= *M. gracilis*).

*Micrathena mitrata*:—F.P.-Cambridge, 1904, Biologia Centrali-Americana, Araneidea, 2: 538.



Figures 28-40. *Micrathena mitrata* (Hentz). 28-29. Male. 28. Dorsal. 29. Lateral. 30-37. Female. 30. Lateral. 31. Dorsal. 32. Posterior median eyes. 33. Left lateral eyes. 34-37. Epigynum. 34. Ventral. 35. Posterior. 36. Lateral. 37. Posteriordorsal. 38-40. Male left palpus. 38. Lateral. 39. Mesal. 40. Submesal, expanded.

Scale lines. 0.1 mm; except Figures 28-31, 1.0 mm.

Abbreviations. C, conductor; E, embolus; M, median apophysis; P, paracymbium; PM, paramedian apophysis; R, radix; S, subtegulum; T, tegulum; Y, cymbium.

Reimoser, 1917. *Verhandl. Zool. Bot. Ges. Wien*, 67: 104. Roewer, 1942, *Katalog der Araneae*, 1: 966. Kaston, 1948, *Connecticut State Geol. Natur. Hist. Surv.*, 70: 220, figs. 694–695, ♀, ♂. Bonnet, 1957, *Bibliographia Araneorum*, 2: 2872.

*Micrathena rediviana*:—Comstock, 1912, *Spider Book*, p. 517, fig. 563, ♀. Comstock, 1940, *Spider Book*, rev. ed., p. 530, fig. 563, ♀. Not *Plectana rediviana* Walckenaer, 1841 (= *M. gracilis*).

**Description.** Female from Virginia: Carapace brown with white thoracic rim. Sternum dark brown. Legs brown, slightly lighter than carapace. Dorsum of abdomen white with black marks (Fig. 31). Sides white with black marks (Fig. 30). Venter black. There is a thoracic depression and three pairs of dimples on each side of thorax (Fig. 31). Abdomen with four short posterior spines (Figs. 30, 31). Total length 5.0 mm, carapace 1.7 mm long, 1.4 mm wide. First femur, 1.7 mm; patella and tibia, 1.7 mm; metatarsus, 1.2 mm; tarsus, 0.5 mm. Second patella and tibia, 1.4 mm; third, 0.9 mm. Fourth femur, 1.7 mm; patella and tibia, 1.6 mm; third, 1.1 mm; fourth 0.4 mm.

Male: carapace brown, posterior median eyes on black spots. Sternum black. Legs brown. Dorsum black with paired white pigment spots. Venter black. Carapace with three pairs of dimples (Fig. 28). First coxa with a very small hook. Abdomen rectangular in dorsal outline (Fig. 28). Total length 3.5 mm, carapace 1.4 mm long, 1.2 mm wide. First femur, 1.3 mm; patella and tibia, 1.2 mm; metatarsus, 0.9 mm; tarsus, 0.5 mm. Second patella and tibia, 1.0 mm; third, 0.7 mm. Fourth femur, 1.4 mm; patella and tibia, 1.0 mm; metatarsus, 0.8 mm; tarsus, 0.5 mm.

**Variation.** The dorsal abdominal black marks are smaller in specimens from Guatemala and Panama. Females vary in total length from 4.7 to 6.0 mm long, carapace 1.7 to 2.2 mm long, 1.4 to 1.9 mm wide. Males vary in total length from 3.0 to 3.7 mm, carapace 1.5 to 1.8 mm long, 1.1 to 1.2 mm wide. The largest female came from Mexico.

**Diagnosis.** Unlike other species north of Mexico *M. mitrata* has three pairs of dimples on the carapace (Fig. 31). The female differs from *M. funebris* in the absence of the anterodorsal tubercle on the abdomen (Fig. 30) and the presence of openings of the epigynum in a depression (Figs. 34, 35). The male palpus has a smaller, differently shaped, smooth paracymbium (Fig. 38), and a median apophysis folded back on itself, its tip sclerotized (Figs. 39, M in 40).

**Natural History.** *Micrathena mitrata* is found in deciduous forest, woodland, under trees, sometimes in shrubs and usually in the shade.

**Distribution.** From Maine to Wisconsin and Kansas, south to Mexico and Panama, but absent from the Florida peninsula (Map 2).

### *Micrathena sagittata* (Walckenaer) Figures 41–54, Map 2

*Plectana sagittata* Walckenaer, 1841, *Histoire Naturelle des Insectes, Aptères*, 2: 174. The name was applied to Abbot illustration of Georgia Spiders, p. 8, fig. 50. Photocopy of the Abbot manuscript in the Museum of Comparative Zoology, examined.

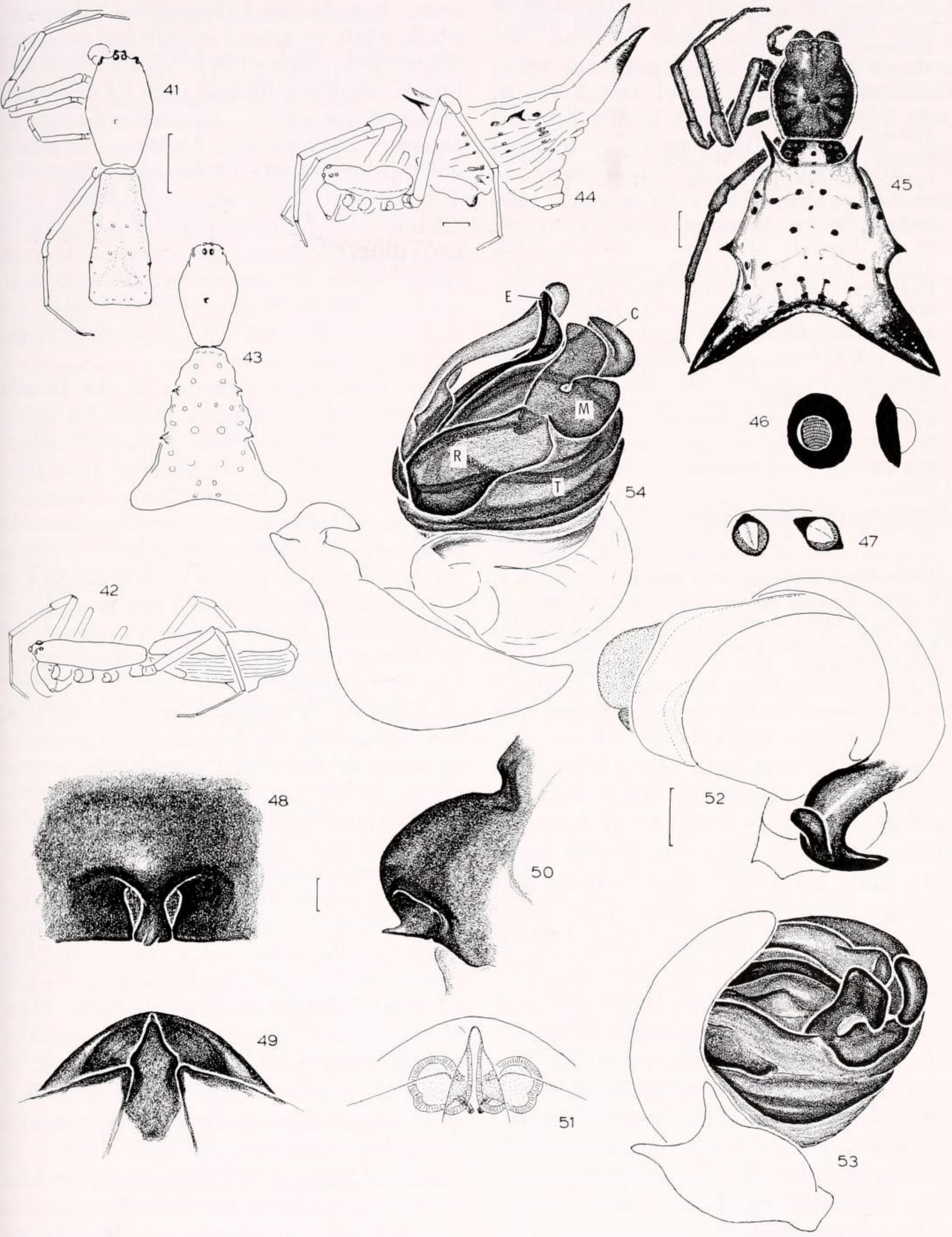
*Epeira spinea* Hentz, 1850, *J. Boston Soc. Natur. Hist.*, 6: 21, pl. 3, fig. 9, ♀. Syntypes from Atlantic states in the Boston Society of Natural History, destroyed.

Figures 41–54. *Micrathena sagittata* (Walckenaer). 41–42, Male. 41. Dorsal. 42. Lateral. 43. Subadult male. 44–51. Female. 44. Lateral. 45. Dorsal. 46. Posterior median eyes. 47. Left lateral eyes. 48–51. Epigynum. 48. Ventral. 49. Posterior. 50. Lateral. 51. Posterior, cleared. 52–54. Male left palpus. 52. Lateral. 53. Mesal. 54. Mesal, expanded.

Scale lines. 0.1 mm; except Figures 41–45, 1.0 mm.

Abbreviations. C, conductor; E, embolus; M, median apophysis; R, radix; T, tegulum.





*Acrosoma bovinum* Thorell, 1859, Oefv. Svensk Vet. Ak. Forh., 16: 301, ♀. Female holotype from Alabama, lost (not in Natural History Museum, Stockholm).

*Acrosoma spinea*:—Emerton, 1884, Trans. Connecticut Acad. Sci., 6: 326, pl. 38, figs. 5–8, ♀, ♂; 1902, Common Spiders, p. 190, figs. 437, 440–442, ♀, ♂, web.

*Acrosoma sagittatum*:—McCook, 1893, American Spiders, 3: 214, pl. 21, figs. 8, 9, ♀, ♂.

*Micrathena sagittata*:—F.P.-Cambridge, 1904, Biologia Centrali-Americana, Araneidea, 2: 536, pl. 51, figs. 20, 21, ♀, ♂. Comstock, 1912, Spider Book, p. 514, figs. 189, 558–561, ♀, web. Reimoser, 1917, Verhandl. Zool. Bot. Gesell. Wien, 67: 140, pl. 9, fig. 29, ♀. Petrunkevitch, 1930, Trans. Connecticut Acad. Sci., 30: 259, figs. 111–114, ♀, ♂. Comstock, 1940, Spider Book, rev. ed., p. 527, figs. 189, 558–561, ♀, web. Roewer, 1942, Katalog der Araneae, 1: 967. Kaston, 1948, Connecticut Geol. Natur. Hist. Surv. 70: 219, figs. 690–693, 2028, ♀, ♂, web. Bonnet, 1957, Bibliographia Araneorum, 2: 2876.

*Micrathena comstocki* Archer, 1951, Amer. Mus. Novitates, no. 1487: 10, figs. 15–17, ♀. Female holotype from Royal Palm State Park [Royal Palm Area, Everglades National Park], Dade County, Florida in the American Museum of Natural History, examined. NEW SYNONYMY.

*Micrathena sagittata emertoni* Archer, 1951, Amer. Mus. Novitates, 1487: 10, figs. 18, 22, ♀. Female holotype from Norwell, Plymouth Co., Massachusetts, in the American Museum of Natural History. NEW SYNONYMY.

**Description.** Female from Virginia: carapace brown, darker on sides of thorax. Sternum, legs brown. Dorsum of abdomen white to yellow with black sclerotized disks; black anteriorly above carapace and posterior spines black (Fig. 45). Sides black with white patches. Venter black around spinnerets, with paired white patches. Abdomen with three pairs of spines, the posterior ones largest (Figs. 44, 45). Total length from between the posterior spines 8.0 mm, carapace 3.1 mm long, 2.5 mm wide. First femur, 3.3 mm; patella and tibia, 3.0 mm; metatarsus, 1.9 mm; tarsus, 0.9 mm. Second patella and tibia, 2.8 mm; third, 1.6 mm. Fourth femur, 3.7 mm; patella and tibia, 3.0 mm; metatarsus, 2.1 mm; tarsus, 0.9 mm.

Male from Virginia: carapace brown.

Posterior median eyes on black spots. Sternum, legs brown. Dorsum of abdomen black, white on lateral margin and posterior white marks. Sides black, venter black and brown. Posterior median eyes 1.2 diameters of anterior medians. Laterals subequal to anterior median eyes. Abdomen trapezoidal, dorsoventrally flattened (Fig. 41). Total length 4.7 mm, carapace 1.9 mm long, 1.2 mm wide. First femur, 1.6 mm; patella and tibia, 1.5 mm; metatarsus, 1.0 mm; tarsus, 0.6 mm. Second patella and tibia, 1.2 mm; third, 0.8 mm. Fourth femur, 1.8 mm; patella and tibia, 1.4 mm; metatarsus, 1.0 mm; tarsus, 0.6 mm.

**Variation.** The abdomen of the female may be white to golden orange in color. The posterior abdominal spines of specimens from southern Florida are longer than those from more northern areas. Interestingly some Mexican specimens have minute posteroventral spines like related tropical species. Females vary in total length 5.4 to 8.6 mm, carapace 2.9 to 3.5 mm long, 2.2 to 2.7 mm wide. Males vary in total length 4.2 to 5.9 mm, carapace 2.0 to 2.5 mm long, 1.3 to 1.6 mm wide.

**Diagnosis.** *Micrathena sagittata* females are recognized by having three pairs of spines with the posterodorsals the largest (Figs. 44, 45), and there are no posteroventral spines in specimens north of Mexico as there are in some related tropical species. The openings of the epigynum are in depressions on the posterior face of a bulge (Figs. 48–51). The male, unlike other species of the area, has a trapezoidal abdomen, widest posteriorly (Fig. 41) and a distinct, biforked median apophysis (Figs. 53, M in 54). The paracymbium, unlike that of other North American species, is recurved, pointing back (Fig. 52) with a spur on its side. Juveniles also have a triangular abdomen (Fig. 43).

**Natural History.** This species is found on shrubs in deciduous forest and woods.

**Distribution.** From southern New Hampshire to Minnesota, Nebraska, south to Costa Rica.

*Micrathena gracilis* (Walckenaer)

Plate 1; Figures 55–68; Map 2

*Epeira gracilis* Walckenaer, 1805, Tableau des Araneides, p. 65. "An unpublished species from Carolina, communicated by M. Bosc."

*Plectana gracilis* Walckenaer, 1841, Histoire Naturelle des Insectes, Aptères, 2: 193. The name is applied to the Abbot illustration of the Spiders of Georgia nos. 47, 48. Photocopy of the Museum of Comparative Zoology, examined. I consider this the date of the name.

*Plectana rediviana* Walckenaer, 1841, Histoire Naturelle des Insectes, Aptères, 2: 201. Name for Abbot illustration Spiders of Georgia no. 49. Photocopy in Museum of Comparative Zoology, examined.

*Acrosoma matronale* C. L. Koch, 1845, Die Arachniden, 11: 68, fig. 887. Female from Mexico, lost (not in Berlin Museum).

*Epeira rugosa* Hentz, 1850, J. Boston Natur. Hist. Soc., 6: 21, pl. 3, fig. 10. Type from southern states in the Boston Natural History Society, destroyed.

*Acrosoma rugosa*:—Emerton, 1884, Trans. Connecticut Acad. Sci., 6: 326, pl. 38, fig. 10, ♀; 1902, Common Spiders, p. 189, fig. 439, ♀.

*Acrosoma gracile*:—McCook, 1893, American Spiders, 3: 212, pl. 21, figs. 1–4, ♀, ♂.

*Micrathena matronalis*:—Simon, 1895, Histoire Naturelle des Araignées 1: 852, fig. 902, ♀.

*Micrathena gracilis*:—F.P.-Cambridge, 1904, Biologia Centrali-Americana, Araneidea, 2: 528, pl. 50, fig. 3, pl. 51, fig. 16, ♀, ♂. Comstock, 1912, Spider Book, p. 516, fig. 562, ♀. Reimoser, 1917, Verhandl. Zool. Bot. Ges. Wien, 67: 87, pl. 1, fig. 1, ♀. Comstock, 1940, Spider Book, rev. ed., p. 529, fig. 562, ♀. Roewer, 1942, Katalog der Araneae, 1: 966. Kaston, 1948, Bull. Connecticut Geol. Natur. Hist. Surv., 70: 219, pl. 33, figs. 688, 689, ♀, ♂. Bonnet, 1957, Bibliotheca Araneorum, 2: 2868. Chickering, 1961, Bull. Mus. Comp. Zool., 125: 421, figs. 72–77, ♀, ♂.

*Micrathena nigrior* Chamberlin and Ivie, 1936, Bull. Univ. Utah, biol. ser. 3(5): 58, figs. 134–135, ♀. Four female syntypes from Barro Colorado Island, Panama Canal Zone, in the American Museum of Natural History, examined.

**Description.** Female from Virginia: carapace brown, darker on sides and middle of thorax. Sternum maculated white and brown. Legs brown. Dorsum of abdomen whitish with dark spots and dark brown sclerotized spots and dark brown spines (Fig. 59). Sides brown with white spots and dark brown sclerotized spots. Thoracic

depression small, round (Fig. 59). Dorsum of abdomen with three pairs of spines and two pairs of posteriorly directed spines (Figs. 58, 59). Total length 8.5 mm, carapace 3.0 mm long, 2.2 mm wide. First femur, 2.3 mm; patella and tibia, 2.2 mm; metatarsus, 1.4 mm; tarsus, 0.9 mm. Second patella and tibia, 2.0 mm; third, 1.4 mm. Fourth femur, 2.7 mm; patella and tibia, 2.2 mm; metatarsus, 1.5 mm; tarsus, 0.8 mm.

**Male:** carapace brown, thoracic region darker. Legs brown. Dorsum of abdomen whitish, venter blackish. There is a round, circular thoracic depression (Fig. 55). Total length 4.8 mm, carapace 1.4 mm long, 0.9 mm wide. First femur, 0.8 mm; patella and tibia, 0.9 mm; metatarsus, 0.6 mm; tarsus, 0.4 mm. Second patella and tibia, 0.9 mm; third, 0.6 mm. Fourth femur, 1.2 mm; patella and tibia, 0.8 mm; metatarsus, 0.5 mm; tarsus, 0.4 mm.

**Variation.** The species is quite variable in color. Females vary in total length 7.0 to 10.8 mm, carapace 2.6 to 3.7 mm long, 1.7 to 2.5 mm wide. Males vary in total length 4.2 to 5.1 mm, carapace 1.3 to 1.6 mm long, 0.9 to 1.0 mm wide.

**Diagnosis.** The female can readily be recognized by the often gray abdomen with ten spines (Figs. 58, 59) and by the laterally flattened tip of the cone of the epigynum (Figs. 62–65). The male as well as juvenile males have an elongate abdomen more than three times as long as wide (Figs. 55, 56), the palpus has a round hookshaped paracymbium (Fig. 66), a complex conductor (C) difficult to make out (the basal lobe is probably the paramedian apophysis) and a minute median apophysis with a filamentous attachment (Figs. 67, M in 68).

**Natural History.** *Micrathena gracilis* is found in dense woods, the web in shaded areas, often on bushes. A study of the web was published by B. E. Dugdale (1969); the orb observed had 44 radii and about as many spirals. The orb had a radius of 17 cm.

**Distribution.** The species is found from

eastern Massachusetts, Michigan, Wisconsin, Nebraska, Texas, Sonora, to Panama, absent from southern Florida (Map 2).

### *Gasteracantha* Sundevall

*Gasteracantha* Sundevall, 1833, *Conspectus Arachnidum*, p. 14. *Gasteracantha cancriformis* is the type species since the only other species name originally included is *G. hexacantha*, a synonym of *G. cancriformis*. The name is feminine. Dahl, F. 1914, *Mitt. Zool. Mus. Berlin*, 7: 235–301. Benoit, 1962, *Ann. Mus. Royal de l'Afrique Centrale*, 8 ser., sci. zool., 112: 1–70. Emerit, 1974, *Faune de Madagascar*, 38: 1–216.

*Vibradellus* Chamberlin, 1925, *Bull. Mus. Comp. Zool.*, 67: 214. Type species by original designation and monotypy *V. carolinus* Chamberlin (= *Gasteracantha cancriformis*).

*Note.* Sundevall cited Latreille, 1831 as author of the name *Gasteracantha*. However, *Gasteracantha* Latreille (1831 *Cours d'Entomologie*, p. 530) is a *nomen nudum* since no species are included; it is thus an invalid name since it lacks an indication (ICZN, Art. 16, V). Bonnet (1957) also erroneously cites Latreille (1831) as author.

The list of synonymy of *Gasteracantha* is incomplete; a complete list is found in Emerit, 1974. There are two excellent revisions for the genus available, one of African species by Benoit and one of Madagascan species by Emerit. Both point out that *Gasteracantha* species are generally variable and difficult to separate. But this had been noted previously by Dahl (1914) in his world-wide study.

*Diagnosis.* The female carapace is almost square in outline (Figs. 71, 72) not longer than wide nor rebordered on the sides as that of *Micrathena*. It is high in front. Unlike related African genera, there

is only one transverse row of black discs on the anterior of the abdomen dorsum; the abdomen has one or two pairs of spines laterally and one pair posteriorly (Figs. 71, 72). There is a sclerotized, central bulge on the venter of the abdomen of the female between genital groove and spinnerets, not present in *Micrathena* (Figs. 71, 73). Unlike *Micrathena*, *Gasteracantha* has a large canoe-shaped tapetum in the posterior median eyes (Fig. 75). Together with *Micrathena*, *Gasteracantha* differs from other genera in having the spinnerets on a cone or their base surrounded by a sclerotized annulus (Fig. 73).

*Description.* *Gasteracantha* species are brightly colored. The sclerotized, square carapace is high in the head region and has a deep thoracic groove (Figs. 71, 72). The eyes are subequal, small, the anterior median eyes their diameter apart, the posterior medians more than their diameter. All secondary eyes have a canoe-shaped tapetum (Figs. 75, 76). The laterals on each side are far from the medians (Fig. 74). The height of the clypeus equals the diameter of the anterior median eyes (Fig. 74). The heavy chelicerae of *G. cancriformis* have five teeth on the anterior margin, four on the posterior margin. The legs are short and thick, and the tarsi are very short. The female abdomen is a sclerotized shield with sclerotized lateral spines and dorsal sclerotized discs.

Males are minute (Figs. 69, 70, notice different scale) and less often collected. The median eye area is slightly projecting (Figs. 69, 70). The male lacks the tooth on the proximal end of the palpal femur and a tooth on the endite present in many Araneidae. None of the coxae and none of

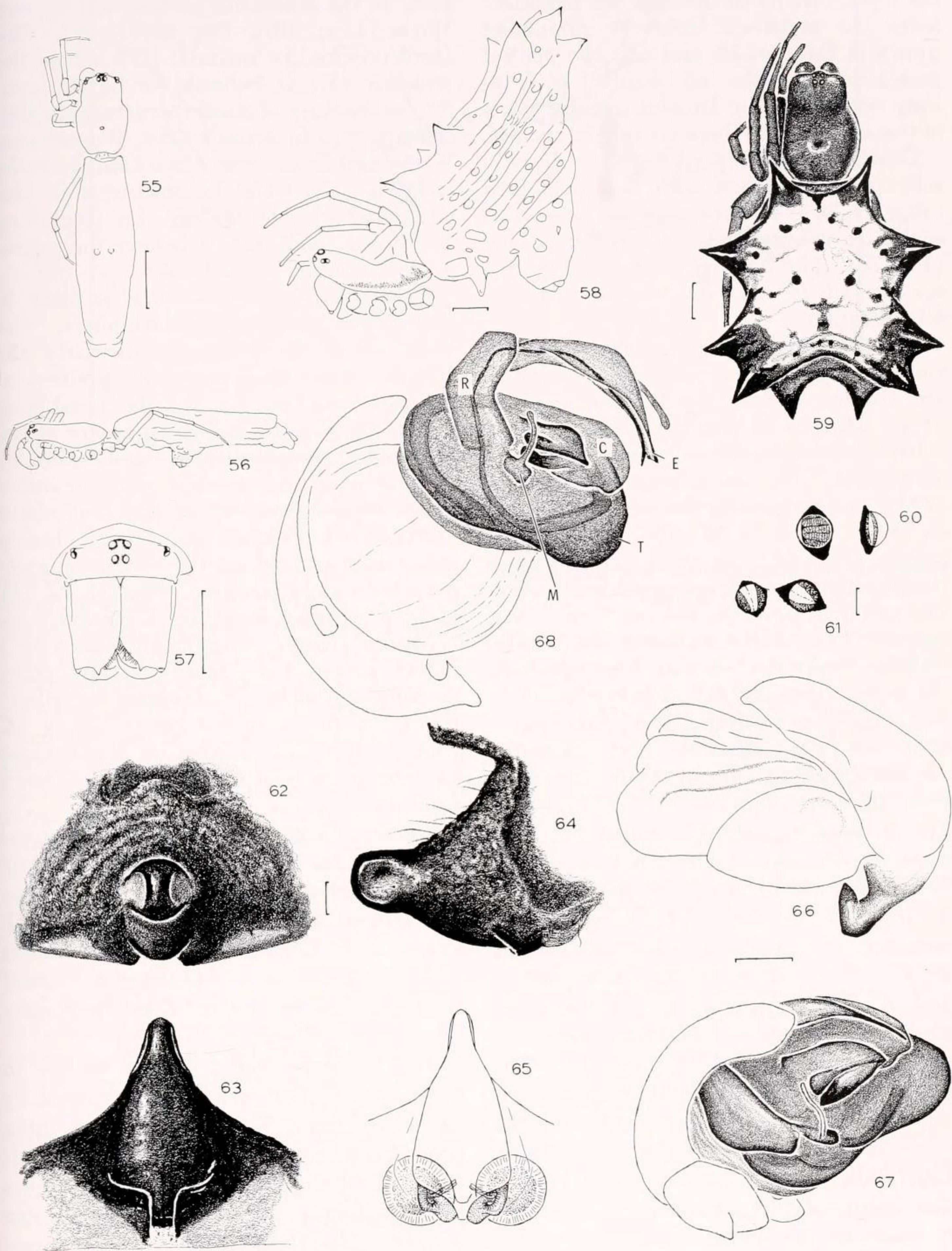
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Figures 55–68. *Micrathena gracilis* (Walckenaer). 55–56. Male. 55. Dorsal. 56. Lateral. 57–65. Female. 57. Eye region and chelicerae. 58. Lateral. 59. Dorsal. 60. Posterior median eyes. 61. Left lateral eyes. 62–65. Epigynum. 62. Ventral. 63. Posterior. 64. Lateral. 65. Posterior, cleared. 66–68. Male left palpus. 66. Lateral. 67. Mesal. 68. Mesal, expanded.

*Scale lines.* 0.1 mm; except Figures 55–59, 1.0 mm.

*Abbreviations.* C, conductor; E, embolus; M, median apophysis; R, radix; T, tegulum.



the distal articles of the legs are modified. Since the abdomen lacks the prominent spines of the females and also the ventral protuberance, males are difficult to associate with matching females in other parts of the world where there are several species.

*Genitalia.* The epigynum is a heavily sclerotized projection with a median lobe (Figs. 77–80). The openings can be seen on each side of a septum on the posterior face (Fig. 79). The internal genitalia (Fig. 81) are difficult to make out because of heavy sclerotization.

The palpus is relatively simple. In mesal view of the contracted palpus three sclerites are visible: distally the filiform embolus (Figs. 83, E in 84); in the center a round sclerite with its distal edge folded and sculptured, the paramedian apophysis (PM); and proximally the median apophysis (Figs. 83, M in 84). In the expanded palpus (Fig. 84) the radix (R) becomes completely free and transparent hematocha-like material, probably the conductor (C), appears behind the embolus (E). The embolus lacks the parallel lobe (perhaps the terminal apophysis) of *Micrathena*. In the expanded palpus, the paramedian apophysis (PM) slips down and behind the median apophysis (M) as result of pressure from the soft conductor (C) (Fig. 84). The *Mastophora* palpus is similar but lacks a paramedian apophysis (Levi, in press). The palpal patella lacks strong setae. The paramedian apophysis (PM) was called terminal apophysis by Emerit (1968a, 1974). This sclerite is in the same position and of similar appearance as the paramedian apophysis of *Acanthepeira* and other genera (Levi, 1976; in press). The *Acanthepeira* paramedian apophysis is doubtless the same structure as that of the complex palpus of *Eriophora* (Levi, 1970) which was studied by Comstock (1910). The origin of this structure may perhaps be seen in the *Verrucosa* palpus (Levi, 1976, figs. 8, 9) in which it appears to be the basal end of the conductor. It is also

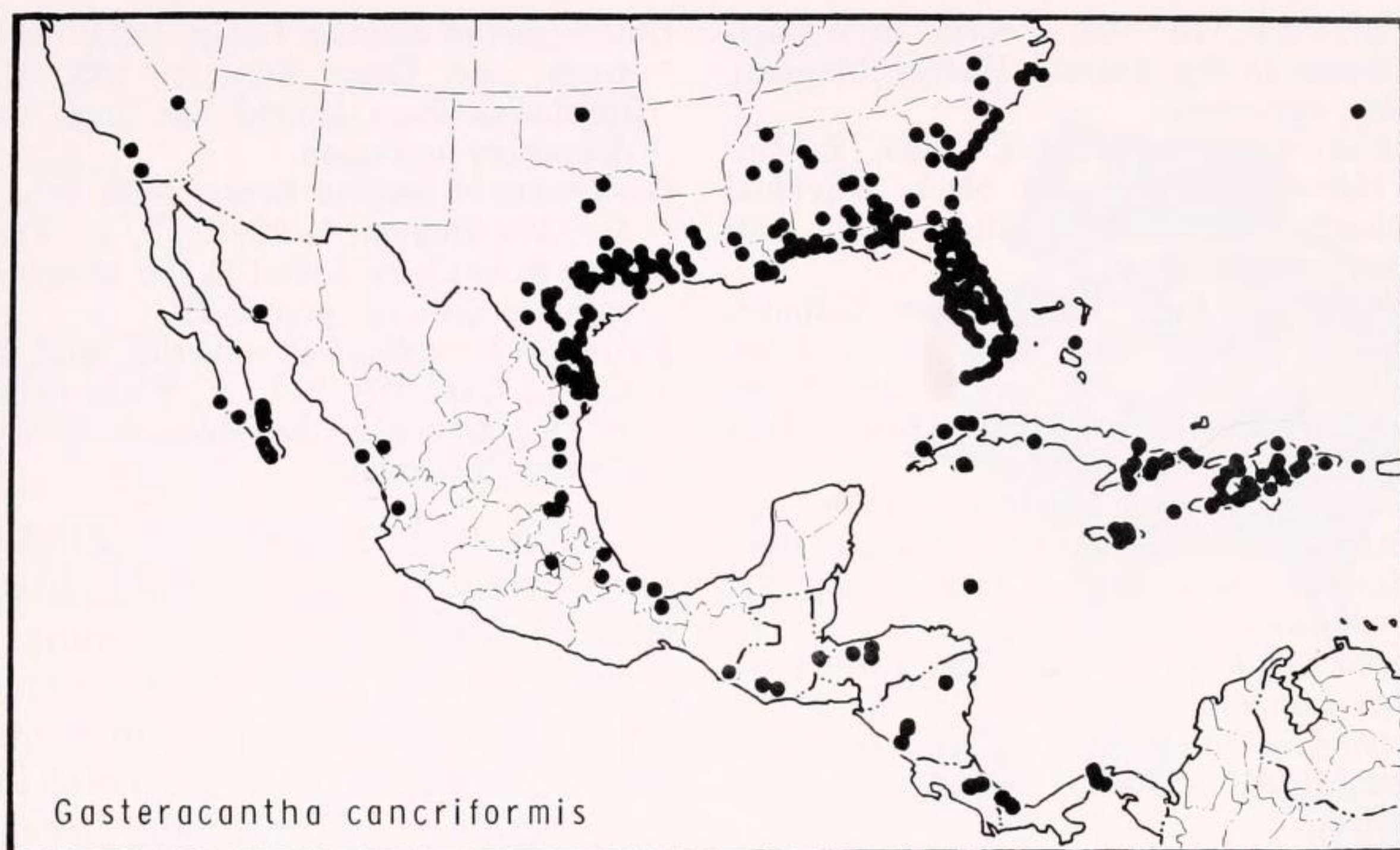
close to the conductor in *Wagneriana* and *Wixia* (Levi, 1976, figs. 69–71, 98). The hematodocha-like material (C) behind the embolus (E) is believed to be the conductor, because of similar structures in similar positions in *Acanthepeira*, *Wagneriana*, *Wixia*, and *Scoloderus*. Since *Gasteracantha* lacks a sclerotized conductor and also additional lobes on the embolus (including a terminal apophysis), I believe the palpus to be simplified secondarily.

*Relationship.* *Gasteracantha* is close to *Micrathena* and also to *Mastophora*. The structure of the palpus, particularly the lateral (rather than proximal) position of the tegulum (Figs. 83, 84), the mesal position of all sclerites, and the presence of the paramedian apophysis (PM) and conductor suggest close relationship with *Acanthepeira*, *Wagneriana*, *Wixia*, and *Scoloderus* (Levi, 1976). Further indication of a highly specialized araneid are the widely separate eyes, the square carapace (Figs. 71, 72, 74) and the modified structure of the abdomen.

*Natural History.* *Gasteracantha* biology is better known than that of many other araneids (*Araneus diadematus* excepted) thanks to the beautiful researches of M. Emerit. His many studies on Madagascan *Gasteracantha versicolor* are listed in Emerit (1974).

*Species.* *Gasteracantha* is a cosmopolitan genus. As far as we know, there are only one or perhaps two species in America, both known to Linnaeus 200 years ago; *G. tetracantha* (Linnaeus) in the West Indies and *G. cancriformis* (Linnaeus) found from the southern United States to Argentina.

The literature indicates two species in the Americas, both originally described by Linnaeus from Jamaica: *Gasteracantha cancriformis* and *G. tetracantha*. According to the literature, *G. tetracantha* occurs from California and Arizona to the Greater Antilles. The California and Arizona records come from specimens of the George Marx collection, well-known for erroneous



Map 3. North American distribution of *Gasteracantha cancriformis* (Linnaeus).

records. None were found in recent collections and the species probably does not occur in the Southwest. (There is a specimen in the N. Banks collection from "Cal." which probably also originated with Marx.) Although large collections were available from Jamaica, only one species, *G. cancriformis*, is found and the Linnaeus record may also be a locality error. *Gasteracantha tetracantha* occurs in Puerto Rico, the Virgin Islands, and the Bahamas to the north, exactly those areas where *G. cancriformis* is absent. Many specimens appear to be intergrades having six spines and only a few have completely lost the anterior pair. The intergrades come from the north and the Bahamas, not from the west. I hope to obtain more specimens from the region to determine whether there are one or two species in the West Indies.

Numerous names have been given to populations of *G. cancriformis* but as far as I know there are never two different populations overlapping except perhaps in the West Indies. The niche of the numerous African *Gasteracantha* species seems occupied by species of *Micrathena* in the Americas.

*Gasteracantha cancriformis* (Linnaeus)  
Plate 2; Figures 69–84; Map 3

*Aranea cancriformis* Linnaeus, 1767, *Systema Naturae*, 12 ed., p. 1037. Specimens described from Jamaica, probably lost.

*A. hexacantha* Fabricius, 1787, *Mantissa Insectorum*, 1: 344. Name given with one line of description, but no locality.

*Gasteracantha velitaris* C. L. Koch, 1838, *Die Arachniden*, 4: 33, pl. 269, ♀. Female from Brazil.

*Plectana elipsoides* Walckenaer, 1841, *Histoire Naturelle des Insectes, Aptères*, 2: 155. Name given to fig. 118, p. 13 of Abbot, *Drawings of the Insects of Georgia in America*, photocopy examined.

*Plectana quinqueserrata* Walckenaer, 1841, *Histoire Naturelle des Insectes, Aptères*, 2: 157. Female from Guyana in Walckenaer's collection, lost.

*Plectana sexserrata* Walckenaer, 1841, *Histoire Naturelle des Insectes, Aptères*, 2: 157. Female from Cayenne.

*Plectana atlantica* Walckenaer, 1841, *Histoire Naturelle des Insectes, Aptères*, 2: 167. Female from St. Domingo.

*Gasteracantha rubiginosa* C. L. Koch, 1845, *Die Arachniden*, 11: 55, pl. 878. Female from St. Domingo, West Indies.

*Epeira cancer* Hentz, 1850, *J. Boston Natur. Hist. Soc.*, 6: 23, pl. 3, fig. 13, ♀. Females from South Carolina and southern Alabama in the Boston Natural History Society, destroyed.

*Gasteracantha insulana* Thorell, 1859, *Oefv. Svensk*

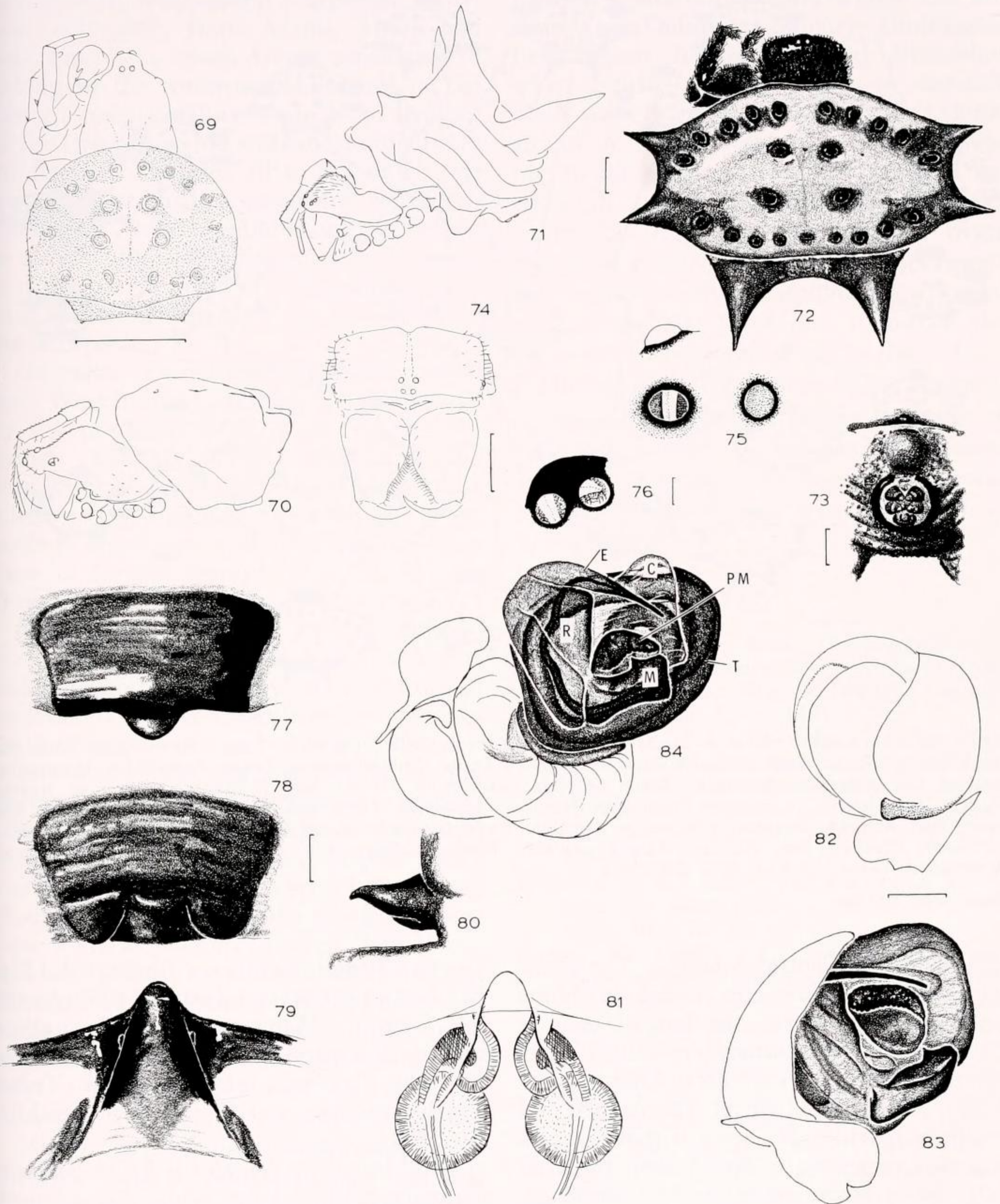
- Vet. Akad. Förh., 16: 302. Female from Galapagos Islands in the Natural History Museum, Stockholm, examined.
- Gasteracantha columbiae* Giebel, 1863, Z. Gesammt. Naturw., 21: 312. A black individual from Colombia, lost (not in Halle (Saale) with the Giebel collection).
- Gasteracantha kochii* Butler, 1873, Trans. Entomol. Soc. London, p. 169. New name for *G. hexacantha*:—C. L. Koch, 1838, Arachniden, 4, pl. 117, fig. 268. Female from Pará [Belem, Brazil].
- Gasteracantha oldendorffi* Holmberg, 1876, An. Agric. Rep. Argentina, 4: 143. Female from Noter del Río Guayguiraro, [Entre Rios], Argentina, destroyed.
- Gasteracantha callida* O.P.-Cambridge, 1879, Proc. Zool. Soc. London, p. 284, pl. 26, fig. 7, ♀. Female holotype from Trinidad, West Indies, in the Hope Museum, Oxford University, Oxford, not examined.
- Gasteracantha raimondii* Taczanowski, 1879, Horae Soc. Entomol. Rossicae, 15: 106, pl. 1, figs. 25, 26, ♀. Five female syntypes from Lima, Chorillos and Montana de Nancha, Peru, in the Polish Academy of Sciences, examined.
- Gasteracantha raimondii unicolor* Taczanowski, 1879, Horae Soc. Entomol. Rossicae, 15: 107. Two females from Lima, Peru.
- Gasteracantha proboscidea* Taczanowski, 1879, Horae Soc. Entomol. Rossicae, 15: 108, pl. 1, fig. 27, ♂. Two male syntypes from Lima, Peru in the Polish Academy of Sciences, examined.
- Gasteracantha rufospinosa* Marx, 1883, Entomol. Amer., 2: 25, figs. a-f, ♀, ♂. Female and male from Crescent City, Florida, lost (not in National Museum of Natural History).
- Gasteracantha maura* McCook, 1893, American Spiders, 3: 210, pl. 13, fig. 12, ♀. Numerous syntypes, "young and old from California, particularly the southern part . . . and from the islands off the coast," lost (not in Academy of Natural Sciences, Philadelphia).
- Gasteracantha cancriformis*:—McCook, 1893, American Spiders, 3: 211, pl. 14, fig. 9, ♀. F.P.-Cambridge, 1904, Biologia Centrali-Americana, Araneidea, 2: 525, pl. 51, fig. 14, ♀. Petrunkevitch 1930. Trans. Connecticut Acad. Sci., 30: 249, figs. 103, ♀, ♂. Comstock, 1940, Spider Book, rev. ed., p. 526, fig. 556, 557, ♀, web. Roewer, 1942, Katalog der Araneae, 1: 949. Bonnet, 1957, Bibliographia Araneorum, 2: 1945.
- Gasteracantha elliptica* Getaz, 1893, An. Inst. Fis.-geogr. nac. Costa Rica, 4: 105, ♀. Female specimens from around San José, Costa Rica, depository unknown.
- Gasteracantha biolleyi* Banks, 1905, Proc. Entomol. Soc. Washington, 7: 20, fig. 3, ♀. Female holotype from Cocos Island in the Museum of Comparative Zoology, examined.
- Vibradellus carolinus* Chamberlin, 1925, Bull. Mus. Comp. Zool., 67: 214, ♂. Male holotype from South Carolina in the Museum of Comparative Zoology, examined.

*Description.* Female from Florida: carapace, sternum, legs brownish black. Dorsum of abdomen whitish, spines orange-yellow, muscle scars black. Venter black with white spots; spines and ventral sclerotized projection, orange. Total length 7.2 mm, carapace 3.2 mm long, 3.0 mm wide. First femur, 2.5 mm; patella and tibia, 2.6 mm; metatarsus, 1.4 mm; tarsus, 0.8 mm. Second patella and tibia, 2.4 mm; third, 1.6 mm; fourth, 2.4 mm.

Male from Florida: carapace brownish black; sternum black. Legs light blackish brown. Dorsum of abdomen dark gray with white spots; venter black with ventral paired white spots. Total length 2.2 mm, carapace 1.1 mm long, 0.9 mm wide. First femur, 0.8 mm; patella and tibia, 0.8 mm; metatarsus, 0.5 mm; tarsus, 0.3 mm. Second patella and tibia, 0.7 mm; third, 0.4 mm; fourth, 0.7 mm.

*Variation.* There are vast differences in color and shape (Fig. 85). Hispaniola and Jamaican specimens may have an orange carapace and legs. Almost all Florida specimens have orange spines. While black specimens occur occasionally throughout the range, all specimens from Mona Island (west of Puerto Rico) were black with light dorsal patches. Texas specimens were bright yellow in color (washed out in alcohol). The narrowest bodies were found on Mona Island and Jamaica, the widest





Scale lines. 0.1 mm; Figures 69-74, 1.0 mm.

Abbreviations. C, conductor; E, embolus; M, median apophysis; PM, paramedian apophysis; R, radix; T, tegulum.

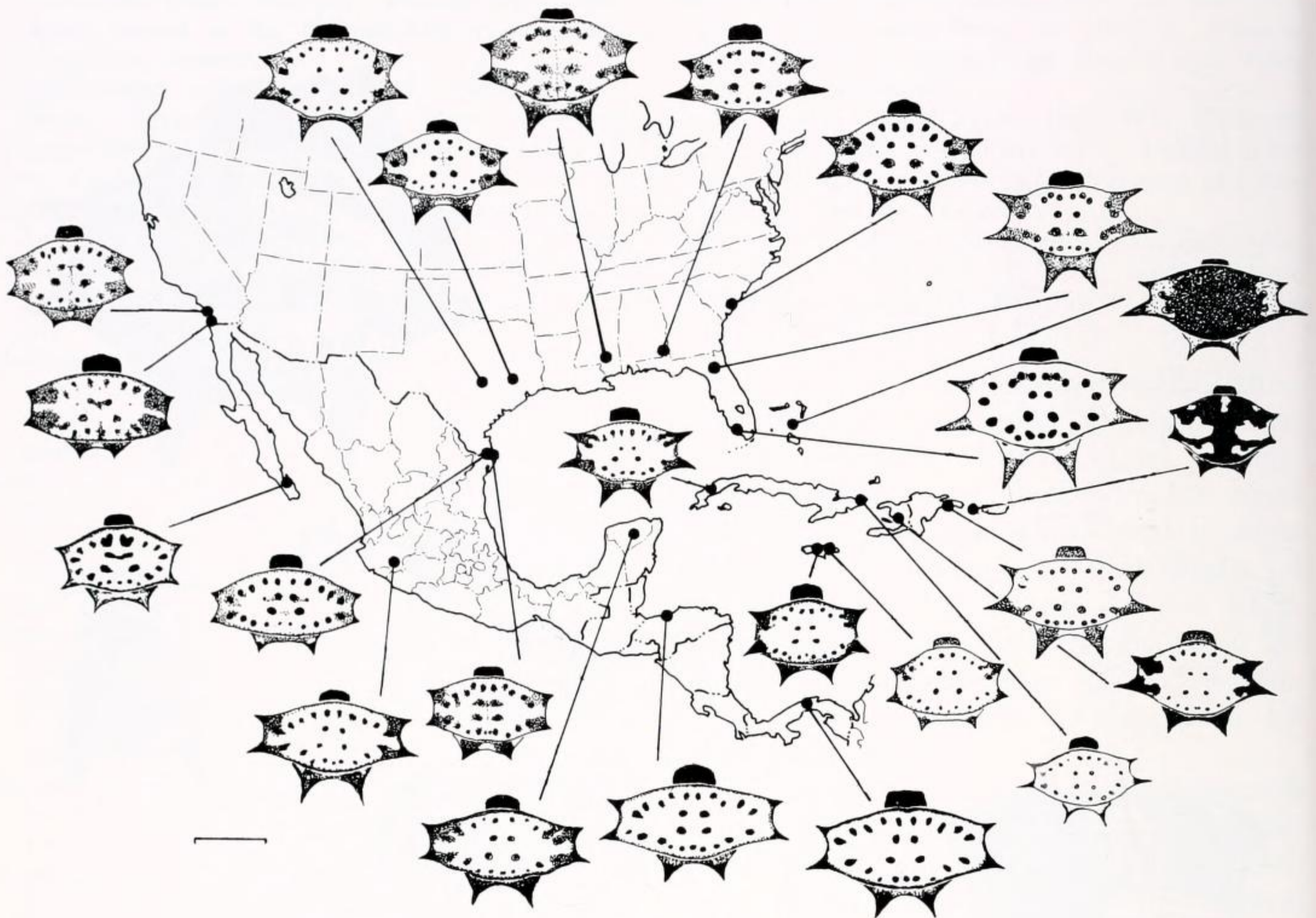


Figure 85. Geographic variation of *Gasteracantha*. Locality data clockwise: Torrey Pines State Park, San Diego Co., California; Laguna Beach, California; Austin, Texas; College Station, Texas; Hattiesburg, Mississippi; Houston Co., Alabama; Charleston, South Carolina; Gainesville, Florida; New Providence, Bahamas; Naples, Florida; Mona Island; La Romana, Dominican Republic; Momance, Haiti; Los Llanos, Cuba; Pinar del Río, Cuba; Port Antonio, Jamaica; Mandeville, Jamaica; Barro Colorado Island, Panama Canal Zone; Carmelina, Honduras; Chichen Itza, Yucatan; Atoyac, Jalisco; Most Southern Palm Grove, Cameron Co., Texas; Brownsville, Texas; La Paz, Baja California.

Scale line: 5.0 mm.

from Texas to Central America. The shortest stubbiest spines are found in Mona Island and California; the longest ones in Florida and the southeastern states. The most acute spines are found in Cuban specimens. A characteristic of Hispaniola and southern Florida specimens is that the second pair of spines is larger than the first pair. Since there are clines of these characters in various directions, it is not easy to segregate subspecies except for island populations.

Unusual variations are the additional round plates found at times on the dorsum of the abdomen. The specimen from

Laguna Beach, California illustrated (Fig. 85) has an extra asymmetrical plate on the left anterior. Many specimens throughout the North American range have the median posterior plate split into two plates (Texas, South Carolina, and Dominican Republic, Fig. 85).

Total length of females is 5.8 to 8.6 mm, carapace 2.3 to 3.1 mm wide. Total length of males 1.9 to 2.7 mm, carapace 0.8 to 1.0 mm wide. Size variation is about the same throughout the southern states.

*Species problems.* Archer judging by museum labels, considered specimens from the western states to be *G. servillei* (Guérin)

and those from the eastern states to be *G. cancriformis*, with several subspecies. However collections from Austin, Texas had both specimens which Archer considered to belong to the western species and to the eastern species. Since there is no overlap of the two forms, but instead intermediates are found, I consider all to belong to one species. The eastern specimens were considered by Archer (unpublished) to belong to several different subspecies, but almost as many were labeled as intermediates (e.g. from northern Florida), as belonging to the subspecies.

*Diagnosis.* Females can be distinguished from West Indian *G. tetracantha* (Linnaeus) by the presence of six spines on the abdomen (Figs. 71, 72); *G. tetracantha* has only four. Males of *G. tetracantha* have the sclerites of the palpus, especially the paramedian apophysis, relatively smaller than those of *G. cancriformis* (Figs. 83, 84), although all parts are of the same shape.

*Natural History.* The striking appearance, conspicuous webs and diurnal habits make this one of the easily collected tropical spiders. The web is found between branches on shrubs and even on buildings (Plate 2). It is made in the morning and is usually inclined at an angle, sometimes near vertical (Plate 2). The outer threads are decorated with flocculent tufts of silk (Marples, 1969) and the spider rests in the open hub. Young Madagascan *Gasteracantha versicolor* may have a stabilimentum (Emerit, 1968b).

Adult males have been collected in Florida from November to February; in Alabama in August; in Texas in April, June, July, and October and in California during July. Adult females can be collected throughout the year in Florida and Texas.

Muma (1971) found *Gasteracantha cancriformis* webs in central Florida orchards in trees, between trees and also in mixed mesophytic woods at a height of less than 1 to more than 6 m. The female's web has 10 to 30 spiral lines, the viscid area spanning 30 to 60 cm diameter. The prey caught are flies, moths, and beetles. The spider

completes the life cycle in a year. Females mature in late fall or early winter and are found from October to January. Adult males first appear in October and November when females are one-third to one-half adult size. Adult males hang from a single strand of silk adjacent to a female's web, one to three per web. The tiny males accomplish sperm induction just prior to courtship. Egg-sacs are flattened ovate masses of tangled white, yellow, and green silk, marked with a longitudinal stripe of dark green silk. They are found on the underside of leaves adjacent to the webs.

*Distribution.* *Gasteracantha cancriformis* is found from North Carolina to Southern California south to northern Argentina (Map 3). Specimens occasionally get transported; one female was found among fruit in Seattle.

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